U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 950

Air Pollution Abstracts
Volume 3, Number 12
December 1972

Environmental Protection Agency, Research Triangle Park, N C

Dec 72

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. APABCA-3-12-1972	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Air Pollution Abstracts Volume 3, No. 12		5. REPORT DATE December 1972
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Pollution Technical Information Center Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Same		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 24523 - 25048.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Abstracts Information retrieval		13B 5B

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES 179
	20. SECURITY CLASS *(This page)*	22. PRICE $7.50

EPA Form 2220-1 (9-73)

344023

PB 260 950

Volume 3, No. 12
December 1972
APABCA-3(12)(1972)

AIR POLLUTION ABSTRACTS

24523-25048

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Programs

AIR POLLUTION ABSTRACTS

VOLUME 3, NO. 12 DECEMBER 1972

Prepared by
Air Pollution Technical Information Center (APTIC)
Research Triangle Park, North Carolina 27711

Use of funds for printing this publication approved by the Director, Bureau of the Budget, March 31, 1970

CONTENTS

Introduction 3
APTIC Publications 4
Recent Contract Awards 5
Subject Fields and Scope Notes 7
Abstract Bulletin 9
Subject Index SI-1

The terms that most closely describe the information presented in the documents are arranged alphabetically.

Author Index AI-1

Personal authors are arranged alphabetically. The names are presented last name first. The title of the document is indented below the author's name; when the author is the first author of a title, an asterisk precedes the Abstract Number on the next line.

Publishers Address Listings PI-1

INTRODUCTION

This periodical is intended to inform personnel of the Environmental Protection Agency (EPA), and others who are also professionally interested in air pollution, of selected technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given.

EPA's staff should direct requests for full text duplicates (if not locally available) to APTIC, using the order form provided. Translations of foreign language documents may be arranged for these personnel upon request.

For non-EPA readers, APTIC can provide copies of only those articles that have been written by EPA's air pollution personnel and have not been published in the open literature. Requests for all other articles should be directed to local libraries, publishers, or authors, with the following exception. Copies of EPA's air pollution technical publications in the AP or APTD series, as indicated in the citation, will be provided, while supplies permit, only to certain qualified requesters, e.g., its current contractors, grantees, and air pollution control agencies; a list of these publications is available on request. When requesting any publications from the APTIC, please include the complete citation.

Citations of documents available for purchase from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22151 are designated as NTIS; most are sold for three dollars in paper copy and ninety five cents in microfiche. Registered users of the Defense Documentation Center (DDC) may obtain documents in the AD series for the same service charge from: Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. Citations of documents available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 are designated as GPO.

Translations are cited with their sources whenever possible. If a translation proves to be unavailable from the source cited, or if a translation is cited without a source, it may be located through APTIC or through the National Translations Center, 35 West 33rd Street, Chicago, Illinois 60616.

The serial publications (journals, periodicals, etc.) which are regularly screened for input are listed with their publishers' addresses in one issue in each volume of our abstract bulletin; the most recent list appeared in the December 1971 issue.

As another service, abstracts of all of the literature in APTIC (not just in a single issue of this periodical) on any subject related to air pollution will be provided free of charge upon request. APTIC can search information more recent than that in the current issue of this periodical because of the lapse of time entailed by editorial, make-up, and printing work. More than 1400 subject index terms are available for such searching ---more than those included in the subject index in each issue.

Feedback from our users, including suggestions of articles for abstracting, are always welcome.

APTIC Publications

Air Pollution Aspects of Emission Sources: Petroleum Refineries - A Bibliography With Abstracts, July 1972, GPO No. EP 4.9:110, (price not yet available).

Air Pollution Aspects of Emission Sources: Iron and Steel Mills - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:107, $1.00.

Air Pollution Aspects of Emission Sources: Boilers - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:105, (price not yet available).

Hydrochloric Acid and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:100, $0.55.

Chlorine and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:99, $0.55.

Air Pollution Aspects of Emission Sources: Electric Power Production - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:96, $2.25.

Air Pollution Aspects of Emission Sources: Cement Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:95, $0.50.

Air Pollution Aspects of Emission Sources: Sulfuric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:94, $0.65.

Air Pollution Aspects of Emission Sources: Nitric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:93, $0.45. Air Pollution Aspects of Emission Sources: Municipal Incineration - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:92, $1.00.

Photochemical Oxidants and Air Pollution: An Annotated Bibliography (2 Volumes), March 1971, GPO No. EP 4.9:88, $6.25.

Beryllium and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:83, $0.40.

Asbestos and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:82, $0.50.

Municipal Incineration: A Review of Literature, June 1971, GPO No. EP 4.9:79, $1.00.

Hydrocarbons and Air Pollution: An Annotated Bibliography (2 Volumes), October 1970, GPO No. HE 20.1309:75, $5.00.

Nitrogen Oxides: An Annotated Bibliography, August 1970, GPO No. HE 20.1309:72, $2.75.

Air Pollution Translations: A Bibliography With Abstracts Volume I, May 1969, GPO No. FS 2.93/3:56, $1.75.

Air Pollution Translations: A Bibliography With Abstracts Volume II, April 1970, GPO No. HE 20.1309:69, $1.00.

Carbon Monoxide, A Bibliography With Abstracts. 1966, GPO No. PHS 1503, $2.50.

The acronym GPO which appears in the above listing refers to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Orders should be directed to GPO only; payment must accompany all orders.

RECENT CONTRACT AWARDS

from the

Durham Contract Operations
Contracts Management Division, EPA

Contract No. 68-02-0634, RFP No. Du-72-A061 .... *$98,000*
INVESTIGATION TO CONTROL NOx FORMATION IN COAL FIRED UTILITY BOILERS.
Babcock & Wilcox Company, Barberton, Ohio 44203

Contract No. 68-02-0631, RFP No. Du-72-A188 .... *$181,446*
STUDY OF LIMESTONE WET SCRUBBING OF SO2 IN RESEARCH MODEL PILOT SCRUBBER.
Monsanto Research Corporation, 1515 Nicholas Road, Dayton, Ohio 45407

Contract No. 68-02-0636, RFP No. Du-72-A118 .... *$114,795*
MEASUREMENT TECHNIQUES FOR CONTROL SYSTEMS EVALUATION - TOTAL GAS VOLUMETRIC FLOW RATE.
TRW Inc., TRW Systems Group, One Space Park, Redondo Beach, California 90278

Contract No. 68-02-0294, RFP No. Du-72-A144 .... *$50,616*
NON-PERSONAL SERVICES FOR SAMPLE ACQUISITION AND ANALYSIS AND PROCESS INSTRUMENTATION EVALUATION AND APPLICATION.
Research Triangle Institute, P.O. Box 12914, Research Triangle Park, North Carolina 27709

Contract No. 68-02-0291, RFP No. Du-73-A001 .... *$199,385*
DETAILED ANALYSIS OF ENERGY POLICY ISSUES RAISED BY STATE IMPLEMENTATION PLANS.
The Mitre Corporation, Westgate Research Park, McLean Virginia 22101

Contract No. CPA 70-146, RFP No. Du-72-A077 .... *$221,610*
DEVELOPMENT OF TWO-STAGE COAL COMBUSTION PROCESS.
Applied Technology Corporation, 136 Delta Drive, Pittsburgh, Pennsylvania 15238

Contract No. 68-02-0645, RFP No. Du-72-A094 .... *$117,266*
FIELD SURVEILLANCE AND ENFORCEMENT GUIDE FOR PETROLEUM REFINERIES.
The Ben Holt Company, 521 East Green Street, Pasadena, L.A. County, California

Contract No. 68-02-0942 RFP No. Du-72-C788 .... *$32,278.31*
COACH, TO BE USED AS A MOBILE LABORATORY.
The Gerstenslager Company, 1425 E. Bowman Street, Wooster, Ohio 44691

Contract No. 68-02-0625, RFP No. Du-72-A100 .... *$244,253*
DETAILED DESIGN AND CONSTRUCTION OF PARTICULATE AERODYNAMIC TEST FACILITY.
Acurex Corporation, 485 Clyde Avenue, Mountain View, California 94040

Contract No. 68-02-0623, RFP No. Du-72-A127 .... *$299,990*

THE EVALUATION AND COLLABORATIVE TESTING OF METHODS FOR DETERMINING COMPLIANCE WITH STANDARDS OF PERFORMANCE OF NEW STATIONARY SOURCES: CATEGORY I.

Southwest Research Institute, 3600 South Yoakum Boulevard, Houston, Texas 77006

Contract No. 68-02-0603.. *$57,600*

THE APPLICATION OF HOLOGRAPHIC METHODS TO THE MEASUREMENT OF FLAMES AND PARTICULATE.

TRW Inc., One Space Park, Redondo Beach, California 90271

Contract No. 68-02-0628.. *$96,393*

DEVELOPMENT OF PROCEDURES FOR FLAME CHARACTERISTICS.

North American Rockwell Corporation, Rocketdyne Division, 6633 Canoga Avenue, Canoga Park, California 91304

Contract No. 68-02-0644, RFP No. Du-72-A147 .... *$64,313*

DEVELOPMENT OF CRITERIA FOR THE ALLOCATION OF NATURAL GAS TO VARIOUS REGIONS OF THE UNITED STATES.

Holmes and Narver, Inc., 400 E. Orangethorpe Avenue, Anaheim, California 92801

Contract No. 68-02-0915.. *$32,864*

POLLUTANT CALIBRATION STANDARD GENERATION SYSTEM.

The Bendix Corporation, Process Instruments Division, Corner Edgar & Monroe Avenue, Ronceverte, West Virginia 24970

Contract No. 68-02-0638 RFP No. Du-72-A101 .... *$139,164*

COMPREHENSIVE DATA HANDLING SYSTEM.

IBM Corporation, Federal Systems Division, 18100 Frederick Pike, Gaithersburg, Maryland 20760

Contract No. 68-02-0643 RFP No. Du-72-A146 .... *$97,360*

STUDY OF INDUSTRIAL AND COMMERCIAL USE OF ENERGY IN RELATION TO ENVIRONMENTAL EFFECTS.

Institute of Gas Technology, 3424 South State Street, Chicago, Illinois 60616

Contract No. 68-02-0627 RFP No. Du-72-A065 .... *$59,291*

AN ENFORCEMENT GUIDE FOR MONITORING AIR POLLUTION EMISSIONS IN THE PRIMARY METALLURGICAL INDUSTRIES.

Engineering-Science, Inc., Watergate 600, Suite 888, 600 New Hampshire Avenue, N.W. Washington, D.C. 20037

SUBJECT FIELDS AND SCOPE NOTES

1. EMISSION SOURCES

Information pertaining to an industry, process, or material Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles.

3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

7. EFFECTS--HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

8. EFFECTS--PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals.

9. EFFECTS--MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes public opinion studies, public relations, and public information.

14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

ABSTRACT BULLETIN

EMISSION SOURCES

1972

24523 **APTIC NO. 45436**

Association for Thermal Power Technology

INVESTIGATIONS ON THE STACKS OF THERMAL POWER PLANTS BY A SPECIAL INVESTIGATION COMMITTEE ON THERMAL POWER AND ATOMIC PLANTS. *(Karyoku oyobi genshiryoku hatsudensho genjo chosa iinkai karyoku hatsudensho no entotsu ni kansuru chosa). Text in Japanese. Karyoku Hatsuden (Thermoelectric Power Generation), 23(7):751-791, July 1972.*

Results of investigations of 187 stacks at thermal power plants in Japan, including those under construction, are given. The average stack height is increasing every year. More than 80% of the stacks under construction are higher than 150 m. The flow rate of gases from old stacks is about 10 m/sec, while that of gases from most new stacks is about 30 m/sec. Most of the stacks have more than two kinds of linings, usually of refractory brick and acid-proof brick. The data are summarized in tables and charts.

24524 **APTIC NO. 45535**

National Council of the Paper Industry for Air and Stream Improvement, Inc., New York

FACTORS AFFECTING EMISSION OF ODOROUS REDUCED SULFUR COMPOUNDS FROM MISCELLANEOUS KRAFT PROCESS SOURCES. *Tech. Bull. 60, 37p., March 1972. 6 refs.*

Miscellaneous kraft pulping process point source emissions were examined at 19 different locations in the United States. Most of the emissions, composed predominantly or exclusively of high molecular weight organic sulfur compounds, e.g., methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, were generated from black liquor handling. Total emission levels from brown stock washer systems, weak and heavy black liquor oxidation systems, and smelt tank vents totaled from less than 0.2 to as high as 2.0 lb of reduced sulfur per ton of air dried pulp. The single most controllable factor accounting for the highest emission rates was reuse of process effluents high in soluble sulfide content. Factors affecting emission rates and possible control methods are reviewed.

24525 **APTIC NO. 45665**

PRESERVATION OF THE ENVIRONMENT AND THE POWER GENERATING PLANTS. *(La preservation de l environnement et les industries productrices d energie). Text in French. GAZ Aujourd hui, 96(6):239-250, June 1972. (Presented at the World Energy Conference, London, England, May 1972.)*

General problems of air deterioration and thermal pollution caused by power plants and the contribution of the power generating industry to environmental quality preservation are reviewed. A rise of 160% in the energy consumption and of about 50% in the share of petroleum products, primarily at the expense of solid fuel, is predicted for 1970-1980. The share of nuclear energy in total energy production will be below 5% in 1980. The rate of increase in energy consumption of non-industrial consumers will lag behind that of industry. Power plants are responsible for 50% of the total sulfur dioxide and for some 30% of the total particulate emissions. The dispersion of waste gases can be improved by means of high stacks. Dust collectors, cyclones, and electrostatic precipitators, with efficiencies up to 99.5%, are used by coal-fired power plants, while such equipment is usually unnecessary for oil-fired boilers. Sulfur dioxide can be removed from waste gases by means of limed water spray, dolomite, or activated carbon. While there are no practicable methods for sulfur removal from coal, the sulfur content in light petroleum distillates can be reduced to below 1% by hydrodesulfurization. Current studies in different countries are concerned with such problems as technological improvements; possibilities of increasing dust collector efficiencies by means of chemical additives; the removal of fine soot from oil-fired boiler waste gases; the reduction of nitrogen oxides emissions by applying two-stage combustion; SO2 removal by wet and dry methods; and the desulfurization of oil residues. Analytical and monitoring techniques are surveyed.

24526 **APTIC NO. 45725**

TOTAL ENERGY AIR CONDITIONING AND HEATING FOR THE QUEEN MARY. *Refrig. Air Cond., 75(892):41-42, July 1972.*

An electric energy and heat producing system was installed on the Queen Mary, which in a load situation offering simultaneously heavy heating and air conditioning demands, uses a gas engine burning natural gas with a high rate of heat recovery. The former Cunard liner was sold to the City of Long Beach, California, and converted into a floating hotel, museum, and conference center. Conversion included providing air conditioning, heating, and electrical energy. A heating and air conditioning plant was built on the shore. Steam output was specified at 25,000 lb/hr at 60 lb/sq in. and 100% capacity. Air conditioning was fixed at 2,200 ton/hr of chilled water at 40 F, with a pressure drop in the shipboard system of 55 lb/sq in. A minimum 60% of this capacity was to be available at all times. Redundancy was built in, together with allowance for 10% additional load at some future date, which meant sharing the loads between a number of small units rather than depending on economy of scale in one or two large units. Economy is obtained with a total energy approach in the plant itself. An engine fueled by a limitless supply natural gas runs an on-site generator, which furnishes all the electrical requirements for the area. At the same time, heat from the engine is utilized to produce low-pressure steam. In winter, the steam heats the building, while in summer it is pumped through an absorption chiller to provide air conditioning. Cost and reliability are prime advantages of a total energy system. Costs vary from one area to another, depending on the availability of gas and local electricity authority rates. However, a 30 to 50% saving over the use of commercial electricity is the rule. The plant is located 2500 ft from the ship. It comprises three sections: air conditioning, chiller units, and the main heat recovery system, located in the exhaust gas boilers of the engines, supplied by two water tube boilers. Heat is also recoverable in the boiler cycle.

24527 **APTIC NO. 46137**

THE LUMMUS COMPANY. SNG--CATALYTIC RICH GAS (CRG) PROCESS. *Pipeline Gas J., 199(10):67-68, Aug. 1972.*

The Lummus Company offers the Catalytic Rich Gas Process of the British Gas Council, a catalytic process that operates at pressure levels from low to 600 psig to produce a substitute natural gas of high Btu content. In the CRG process, naphtha is mixed with steam and converted to a substitute natural gas that contains about 98% methane with the remainder carbon dioxide and hydrogen. Naphtha carries with it a small amount of sulfur that is removed within the plant intermittently in the form of zinc sulfide, a solid material which can be disposed of easily. Streams leaving the plant, in addition to the product gas, are carbon dioxide and flue gases, which leave the boiler and various heaters used in the manufacture of synthetic natural gas. Feed desulfurization, gasification, and costs are discussed. (Author introduction modified)

24528 **APTIC NO. 46181**

TURBINE DEVELOPMENTS FOR THE TRUCKING INDUSTRY. *Diesel Equip. Supt., 50(7):46-47, July 1972.*

The reason behind all of the interest in a turbine powered truck is based on several inherent advantages it enjoys over today s diesels. Number one on the list is reliability. There are no periodic tune-ups or adjustments required on the turbine with the only wear being a very slow blade erosion which results in a gradual loss of power. Maintenance costs can be reduced by as much as 45%. A reduction in weight over the diesel engine is another plus for the turbine. The turbine engine also offers a sizable decrease in noise levels. The air cooled gas turbine engine does not require a radiator, hoses, belts, and related troublesome parts. The turbine is also claimed to have superior starting characteristics in cold weather and is welcomed by ecologists for its low exhaust emissions. Presently the turbine has one big drawback--fuel economy. Answers to this problem are mentioned, as well as several turbine truck experiments conducted by the White Motor Company.

24529 **APTIC NO. 46183**

PISTONS MAY GO BUT NOT ALL THE POLLUTION. NEW AUTO ENGINE TYPES STILL WILL NEED CATALYTIC CONTROLS. *Chem. Week, 111(9):33-34, Aug. 30, 1972. 1 ref.*

No replacement for the internal combustion engine is likely to go commercial before the end of the decade, and the three leading replacements will need at least some kind of catalytic device to control emissions. The Wankel, the gas turbine, and the Stirling engine are the three replacement candidates. The newest entry, the Stirling engine, seems to have an edge as an antipolluter. The Stirling engine, which operates continuously at 3000-3500 F, yields exhaust with very little carbon monoxide and hydrocarbon content. The remaining emissions can be eliminated with a thermal or catalytic reactor or exhaust gas recirculation. The turbine also runs continuously at high temperatures, so hydrocarbons and carbon monoxide are easily controlled. However, the Wankel engine does not appear to have a problem with nitrogen oxides. It also does not need high octane gasoline, and it can get by with relatively low grades of lubricating oils. Some other features of these three alternatives to the internal combustion engine are mentioned.

24530 **APTIC NO. 46192**

EXPERIMENTAL STEAM BUSES TAKE OFF ON CALIFORNIA ROADWAYS. *Product Eng., 43(8):11-12, Aug. 1972.*

Recently, three conventional-looking, 51 passenger buses were demonstrated in Sacramento to the California legislature and the press, as one milestone in the Department of Transportation s demonstration project to determine the feasibility of steam power. Since then the buses have been undergoing extensive engineering evaluations to determine their performance and environmental characteristics--including exhaust emissions and noise. The buses will go into regular passenger service in three California cities, which will throw light on customer acceptance as well as provide more engineering data. Results of early emission tests and noise tests are tabulated. Design concepts and drawbacks of the three steam buses are indicated.

24531 **APTIC NO. 46193**

MP AND E S SURVEY OF STEAM POWER SYSTEMS. *Mod. Power Eng., 66(7):51-58, July 1972.*

The importance of steam power systems in industries and in institutions is dramatically reflected in a survey of plants across Canada. A total of 77% of the plants surveyed use steam. Analysis of survey returns by industry shows clothing and textile manufacturers all reporting the use of steam; 94.7% of institutions, 93.8% of food and beverage manufacturers; 93.3% of the paper and allied industries; and 86.4% of the petroleum, coal, and chemical industries. Differences in steam using practices are indicated, with regard to pressures, uses, number of boilers, boiler makeup, boiler blowdown, feedwater controls, economizers, superheaters, standby fuels, pollution control, water supply and treatment, corrosion inhibitors, personnel, equipment, purchasing considerations, and periods of demand. Many oil-using plants use fuel additives to control pollution; paper industries use collectors, scrubbers, and electrostatic precipitators to eliminate pollutants in stack gas.

24532 **APTIC NO. 46266**

K-T COAL GASIFICATION PROCESS--A POLLUTION-FREE FOR PRODUCING SYNTHETIC GAS FUEL. *Ind. Heating, 21(7):1250-1252, 1254, July 1972.*

The Koppers-Totzek process uses commercially-proven technology to produce a gas rich in carbon monoxide and hydrogen that can be converted into valuable fuel and process gases and pipeline quality synthetic natural gas. The coal gasification process is pollution-free and can help to reduce gas shortages. The process can produce synthesis gas, low Btu gas, and a CO and H2-rich gas. Major applications for the process are indicated, and the coal gasification process is outlined. Because of the high temperature reaction in the gasifier, about 2700 F, the raw gas produced is free of condensible organic compounds. Therefore, potential gaseous or liquid pollutants such as low temperature tar, ammonia, or phenolic effluents are not produced. About half of the coal ash is slagged and falls to the bottom of the gasifier into an ash disposal system. The remainder passes out of the gasifier as a dust and is removed from the gas in separation facilities. Hydrogen sulfide removed from the gas is recovered and converted to elemental sulfur.

24533 **APTIC NO. 46364**

IS OIL HEATING LESS POLLUTING? (Ist die Oelfeuerung umweltfreundlich)? Text in German. R.A.S. Rohr-Armatur- Sanitaer Heizungstech., 27(9):433, 1972.

Seven million tons of carbon monoxide are emitted in the Federal Republic of Germany every year, as well as 5 million tons of sulfur dioxide, 3 million tons of hydrocarbons, 2.5 million tons of nitrogen oxides and 2.5 million tons of dust. The main air pollutant is CO, which is not contributed by fuel oil. Light fuel oil has a sulfur content of 0.4%. Measurements have shown that the SO2 of the atmosphere has decreased over the past few years to the extent that the number of coal heaters decreased and the number of oil heaters increased. With a proper burner adjustment the proper supply of combustion air, a size of the combustion chamber that matches the flame size, adequte dimensioning of the stack, and a near stoichiometric combustion, fuel oil can be burned without causing pollution.

24534 **APTIC NO. 46370**

CONSTRUCTIONAL AND ECONOMICAL STUDIES OF SMALL AND MEDIUM INCINERATORS. *(Bautechnische und wohnungswirtschaftliche Untersuchungen an kleinen und mittelgrossen Muellverbrennungsanlagen). Text in German. Sanit. Heizungstech., 37(7):436-437, July 1972.*

A study of the performance, costs, and maintenance of several incinerators in high-rise buildings in the city of Berlin was carried out. The incinerators had initially been planned without auxiliary burners, but they became necessary because of the higher demands concerning dust emission. It also turned out that it was most expedient to burn only 500 to 800 l of trash at one time. This made intermediate storage necessary. Tests with gas as an auxiliary fuel revealed that sufficiently high temperatures could be achieved only with high quantities of gas, 25 cu m/incineration on the average. Two to three incinerations were necessary to take care of all the trash. Smoke development was high. With the incinerators equipped with afterburners the gas consumption rose to 85 to 89 cu m gas/incineration. Through a switch to oil as an auxiliary fuel, temperatures of 900 to 1000 C were reached in the combustion chamber. Through the higher temperatures the combustion was more complete and the smoke development was reduced. At the end of the combustion process which usually was accompanied by smoke emission lasting 1 to 2 minutes no odors could be noticed. A great deal of waste heat was emitted plus 5.5% carbon dioxide. The soot number was four to five. An examination of the newest more automatic incinerators yielded more satisfactory results. There was no large smoke development and the dust emission was reduced to a minimum by the installation of filters. Some odor annoyance of the residents of the lower floors was unavoidable, however. Some of the incinerators had to be shut down because of complaints. The costs of incineration in high-rise buildings were exceedingly higher than the costs for waste collection. For this reason the nine remaining incinerators were shut down.

24535 **APTIC NO. 45418**

Andreyev, V. I., Ya. V. Goryachiy, and K. A. Morozov

THE FUEL LAYER OCCURRING IN THE CARBURETOR INLET PIPE. *(O plenke topliva vo vpusknom truboprovode karbyuratornogo dvigatelya). Text in Russian. Avtomob. Prom., no. 6:8-9, 1972.*

The formation and distribution of fuel layers in double-chamber carburetor inlet pipes of series engines were investigated. The presence of fuel layers may considerably influence the operational parameters of the engine and the toxicity of the exhaust gases. Largest amounts of fuel layers for full load at low engine speed due to low flow rate through the diffusor and relatively high pressure after the throttle were observed. Some 25% of the fuel entering the cylinder head was in the form of layer. The distribution of fuel layers among the individual inlet canals was different and dependent on many factors such as the engine speed. The differences in the fuel layer distribution among the individual canals represents one of the principal causes of differences in the mixture compositions in the individual cylinders. The layer distribution may be also influenced by the fuel throughput ratio of the carburetor chambers.

24536 **APTIC NO. 46097**

Billings, Charles E., Anthony M. Sacco, Wayne R. Matson, Reginald M. Griffin, William R. Coniglio, and Robert A. Harley

MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 22p., 1972. 11 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-69.)*

Results of a survey of mercury concentrations in coal, ash, water, fly ash, and flue gas discharges from a 5,500,000 lb/hr steam generator serving a 775 NMW tutbine-generator set are presented. Representative composites of grab samples were obtained for inlet coal and outlet ash and water. Stack samples were obtained for fly ash and mercury vapor emissions while the unit was operated at 660 NMW (85% of full load). Samples were analyzed by anodic stripping voltammetry, plasma emission spectroscopy, and neutron activation analysis to determine mercury concentration entering the furnace in the coal and leaving the furnace in the flue gas, fly ash, bottom and hopper ash, and water. Method inter-comparisons are discussed. A material balance for mercury has been calculated from fuel, ash, and stack gas flow rates. About 90% of the mercury in the coal is released and appears as vapor discharged in the stack gas while 10% remains in the residual ash. For a 700 MW unit, about 5 lb/day of mercury vapor is released to the atmosphere. (Author abstract)

24537 **APTIC NO. 45878**

Blurton, K. F. and H. G. Oswin

REFUELABLE BATTERIES. *Preprint, Energetics Science, Inc., New York, 22p., 1972 (?). 28 refs.*

In the hydrogen-fueled society (a non-fossil fuel society) proposed, a new battery system is required for both the high-power and medium-power applications. Refuelable batteries are such a possibility. None of the existing metal/air cells meet the requirements as far as power density, energy, and operating cost are considered. Neither do the present storage batteries, e.g., lead acid and nickel/cadmium meet the requirements of the hydrogen-fueled society. The improvements which must be made concerning the metal/air systems to the point where they will provide energy densities of 100 Wh/lb and power densities of 75 to 100 W/lb at acceptable costs/KW and /KWh are: cost of cathode catalyst; irreversibility of the cathode; heat generation by the battery; removal of discharged anodes from the bicell; and adsorption of carbon monoxide by the electrolyte. Improvements must be made in each anode replacement and regenerating cost, and low operating cost. Thus to make zinc/air batteries more viable, the manufacturing cost and the recharging cost of zinc anodes must be decreased. To provide the basis for low cost, high energy density aluminum/and magnesium/air batteries, aluminum and magnesium alloys giving more reversible potentials and having a lower rate of self-discharge are required. The energy and power density of iron/air cells is limited by electronegativity of iron but the intrinsically low cost of iron would allow low cost iron/air cells to be made providing the self-discharge rate of nonpurified iron can be decreased. (Author conclusions modified)

24538 **APTIC NO. 46119**

Bourbon, P., J. Alary, and F. Alengrin

STUDYING FLUORINE EMISSIONS FROM PHOSPHORIC ACID AND FERTILIZER MANUFACTURING SOURCES. *(Etude des emissions fluorees lors de la fabrication de l acide phosphorique et d engrais). Text in French. Tribune CEBEDEAU (Centre Belge Etude Doc. Eaux), 25(343-344): 321-324, June-July 1972.*

Emission measurements were carried out around a phosphoric acid and fertilizer manufacturing plant. The waste gases from the phosphoric acid manufacturing plant, containing 3.8% fluorine, were cleaned by scrubbers at an efficiency of 99%. The daily F discharge was 1.4 kg. The fluorine to silicon ratios ranged from 2.7 to 3.2. The phosphorus pentoxide concentrations were below 3 mg/cu m. The fluorine emissions from the ammonium phosphate production were in a range of 2-50 mg/cu m with an average of 16.4 mg/cu m corresponding to a daily output of 50 kg. Ammonia and its derivatives bound in phosphate, fluoride, and fluosilicate were discharged at a rate of 2 t/day corresponding to a concentration of 550 mg/cu m (50 to 2000 mg/cu m). The superphosphate manufacturing plant, of a capacity of 400 t/day, discharged 150,000 cu m of waste gas with an F concentration of 22.5 mg/cu m daily, corresponding to a daily emission of 80 kg. The superphosphate granulation plant discharged F mostly in the form of hydrofluoric acid, at a rate of 80 kg/day; it was served by three cyclones to reduce the discharge rate to 15 kg/day. The fluorine concentrations measured within a 2-kilometer-radius around the plant ranged from zero to 30 micrograms/cu m. Necrotic manifestations in the vegetation were observed. Fluorine, along with sulfur dioxide and ammonia emissions, may be responsible for the elevated fog frequency in the neighborhood.

24539 **APTIC NO. 46355**

Breuer, Hans

PROGRESS IN THE COMBAT AGAINST DUST AND SILICOSIS. *(Fortschritte bei der Staub- und Silikosebekaempfung). Text in German. Glueckauf (Essen), 108(18):806-814, 1972. 3 refs.*

For evaluation of the fine dust concentration, gravimetric threshold limit values have been recommended and included in legal regulations. Uncertainty exists concerning the determination of the specific harmfulness of fine dust which is not solely determined by its quartz fraction. For the measurement of dusts, gravimetric units with preliminary separation of the coarse dust have been increasingly used. The frequency of the measurements is determined by the type of measuring unit used and by the fluctuation of the dust concentrations. For combating dust development during mining operations the method of wetting the mining area is still widely used. In addition, water spraying drills and portable small high-capacity dust collectors are used. Aveolar deposition and retention are mentioned.

24540 **APTIC NO. 45439**

Brunow, Gosta, Taina Ilus, and Gerhard E. Miksche

REACTIONS OF SULPHUR DURING SULPHATE PULPING. *Acta Chem. Scand., 26(3):1117-1122, 1972. 14 refs.*

The elimination of sulfur from sulfur-containing intermediates formed from arylpropane-Beta-aryl ether structures in lignin during sulfate pulping has been studied with the aid of model compounds. Sulfur(O) disproportionates in the alkaline liquor with the formation of the sulfide ion. The regeneration of sulfide ion is due to disproportionation of zero-valent sulfur rather than the hydrolysis of episulfides as suggested earlier.

24541 **APTIC NO. 46053**

Caldwell, Roger L.

MERCURY IN THE ENVIRONMENT. *Crops Soils Mag., 24(6):13-15, March 1972.*

Mercury is extremely widespread, with by far the greatest amount derived from natural sources. The mercury content ranges from 0.03 to 5 ppb in water; about 0.15 ppb in sea water; 30,000 ppb in coal and oil; from 3 to 1000 ppb in food; from 100 to 1000 ppb in non-food vegetation; and from 10 to 50 ppb in soil. Mercury levels in air vary with location, temperature, wind, and moisture, ranging from 0.7 ng/cu m in air over the open sea to 1 to 200 ng/cu m over land areas. It can reach levels 10 to 1000 times greater in air over deposits of mercury, copper, silver, and gold. It becomes airborne by volcanic eruption, biological activity, evaporation from natural deposits, and man s activities (from industrial waste and combustion processes). Its level in humans has decreased since many households are no longer heated by coal. While agricultural uses of mercury account for a small quantity of total mercury used, there are cases of mercury poisoning coming from fungicides and bactricides. Livestock was fed mercury-treated seed. The possibility of translocation of mercury to the germinated plant from the mercury-treated seed is still the subject of controversy. Cases of mercury poisoning in wild animals, particularly birds, have been reported. Miners, painters, dentists, and seed-treatment personnel, as well as people eating mercury contaminated food (the well-known Minamata disease and the New Mexico poisoning) are exposed to mercury. The symptoms of mercury poisoning are fatigue, headache, poor memory, blurred vision, numbness, emotional irritability, and coma. Mercury first accumulates in the liver and kidney, and later in the brain. Different forms of mercury may be converted biologically into methyl (organic) mercury, the most toxic of all. Alkyl mercury compounds are more easily converted into methyl mercury than aromatic (aryl) mercury compounds. Man s contribution to environmental pollution with mercury is significant, and should be minimized from all sources.

24542 **APTIC NO. 45427**

Chviruk, V. P., N. V. Koneva, and M. I. Ovrutskiy

KINETICS OF THE VAPORIZATION OF MERCURY FROM SODIUM HYDROXIDE SOLUTIONS. *(Kinetika ispareniya rtuti ig rastvorov edkogo natra). Text in Russian. Ukr. Khim. Zh., 38(3):275-276, 1972. 6 refs.*

Vaporization of mercury from sodium hydroxide solutions is a major source of atmospheric pollution. It takes place at plants producing NaOH by the mercury method. Vaporization was determined at various temperatures, rates of stirring, and NaOH concentrations using a dispersion obtained from an industrial source. The rate ranged in various experiments from 10 to the minus 9th power to 7 times 10 to the minus 8th power g/sq cm/hr. It increased with stirring and temperature. It decreased with increased viscosity of the NaOH solution and with decreased concentration of the dispersion if the drop size remained the same. This produced a maximum in the rate as the original suspension was diluted. In all experiments, the rate decreased slowly as the droplets coalesced. (Author abstract)

24543 **APTIC NO. 45747**

Colombo, U. and M. W. Thring

SOOT IN FLAMES: THE TECHNOLOGICAL SIGNIFICANCE OF THE PROBLEMS OF SOOT AND OTHER PARTICLES FORMED IN FLAMES. *Combust. Sci. Technol., 5(5):189-191, July 1972.*

Incandescent soot in flames has been used as a light source. Presently soot is used to increase the radiant emissivity to enable the combustion energy of the fuel to be transferred more rapidly from the flame to the surface to be heated in a boiler or a furnace. It is important to burn all soot particles before the temperature of the flame drops too low and quenches combustion so that no smoke is emitted from stacks. The laws of soot formation, combustion, and its luminous emissivity are important for all combustuon processes and for the production of soot or carbon black for inks or for other purposes. There are a number of processes in which other solids are formed by a reaction between gases or vapors in flames.

24544 **APTIC NO. 45576**

Cross, Frank L., Jr. and J. Ronald Lawson

INCINERATION OF INDUSTRIAL WASTES. *Preprint, Tennessee Univ., Knoxville, 18p., 1972. 7 refs. (Presented at the Industrial Air Pollution Control Conference, Annual, 2nd, Knoxville, Tenn., April 20-21, 1972.)*

The design of industrial waste incinerators depends on the type of waste to be disposed of. Multiple hearth, fluidized beds, and wet air oxidation have been used to dispose of sludges and slurries. Rotary kiln incinerators are used for tars, sludges, plastics, and contaminated water. Liquid waste incinerators are usually quite simple in design but require air pollution control equipment. Chlorine from liquid waste incinerators can be removed by conversion to hydrochloric acid and scrubbing of the HCl with water. Other halogens or chlorine can also be removed by scrubbers. The design of small starved air incinerators, pit incinerators, flow-through furnaces, rotary hearths, rotary kilns, and fluidized beds is mentioned. Odors, visible emissions, and particulates can be removed by high-energy scrubbers (venturi) or electrostatic precipitators with an efficiency of more than 95%. Afterburners, fabric filters, and mechanical collectors can also be used. Costs for such control devices are given.

24545 **APTIC NO. 45419**

Danchev, P. and G. M. Gordon

BULGARIAN COPPER FOUNDRY-GENERATED DUSTS AND THEIR PROPERTIES. (Svoystva pyley medeplavilnykh zavodov Narodnoy Respubliki Bolgarii). Text in Russian. Tsvetn. Metal., no. 4:25-28, 1972. 3 refs.

Chemical and physical properties of dusts separated from waste gases at copper melting plants in Bulgaria are described. Dust Cu contents, decreasing with particle size, were 13-16% and 32-35% in furnace and converter gases, respectively. Copper oxide contents were highest in electric furnace (5.82%); in other gases they were usually between 0.05 and 1.49%. Copper sulfate was found mainly in fine dusts and iron mainly in coarse dust. The silica contents were highest (11-19%) in fine dusts of furnace gases. Zinc concentrations were highest in converter-and furnace-generated fine dusts. Selenium contents reached values up to 700 g/t in fine dust, and a maximum tellurium content of 945 g/t in converter gas-borne dust was determined. The thallium level was about 100 g/t, reaching a maximum of 705 g/t in shaft furnace gases. The molybdenum contents were below 0.38%, and indium contents of 1.4-14 g/t were measured. Germanium was present in concentrations of 8.3 g/t with a maximum of 61.5 g/t. At 16.6-34.1 g/t, the rhenium contents were highest in fine dusts of electric furnaces. Selenium, indium, tellurium, and germanium contents of dusts of converter gases were remarkably high. At 0.04-2.45%, the fraction below 63 micron was lowest for converters; the corresponding percentages for roasting and electric furnaces were in the respective ranges of 74.87-98.3% and 84.2-92.8%. The electric resistivity of dusts precipitated by dry electrostatic filters at 250 C was 4-20 billion Ohms/cm. Selective separation for economic metal recovery is made possible by a great variety of dust collecting devices (inertial separators, cyclones, dry and wet type electrostatic filters, scrubber-electrostatic filter combinations, precipitating chambers, and venturi scrubbers).

24546 **APTIC NO. 46149**

Dyck, G. van

SOME PROBLEMS RELATED TO METALS OCCURRING IN THE DOMESTIC REFUSE TREATMENT PLANTS. *(Quelques problemes de metaux dans les usines de traitement des ordures menageres). Text in French. Rev. Tech. Luxembourg., 64(2):59-69, April-June 1972. 12 refs.*

Problems of the choice of metals in the design of domestic refuse treatment plants are reviewed. The joint application of nickel and chromium to incinerator steel structures results in improved corrosion resistance. A similar effect is obtained by the use of aluminum and silicon as alloying elements, however, they reduce the tensile strength of the steel. The feed zone grates of an incinerator were made of a steel grade containing 28% Cr and 3.5% Ni, while the grates in the drying, ignition, and combustion zones were made of Cr24Ni12-steel. Steam generator tubes, sometimes coated with refractory, are usually made of chromium-molybdenum steel. The wall temperatures in incinerators combined with steam generators should not exceed a certain limit, and auto tires should not be incinerated in such plants. Cyclones, multicyclones, and scrubbers used after incinerators are often made of stainless steels such as those containing 18% Cr, 12% Ni, 2.5% Mo, and 0.10% carbon. Critical zones of electrostatic filters should be made of stainless steel such as Incoloy 825 (22% Cr, 42% Ni, 3% Mo, and 2% copper). A catalytic incinerator, designed to burn incompletely burned waste gases such as methane and carbon monoxide in the presence of water vapor and carbon dioxide at temperatures of 900-1100 C, uses a steel grade alloyed with 14% Cr, 15% Ni, 4% silicon, and a maximum 0.02% C.

24547 **APTIC NO. 46363**

Eckert, Bruno

STATE OF DEVELOPMENT OF AUTOMOBILE GAS TURBINES. PART 2. *(Stand der Entwicklung von Fahrzeug-Gasturbinen). Text in German. Motoretech. Z. (Stuttgart), 33(9):361-365, 1972. 3 refs. PART 1. Ibid, 33(8):320, 1972.*

While gas turbine by the Williams Research Corporation and the A-831-2, developed several years ago by Chrysler, are drives for passenger cars, those by Volvo, Solar, Caterpillar, Nissan, Leyland, and Ford are for trucks. The gas turbine provides no major advantages concerning fuel consumption, manufacturing costs, maintenance requirements and life-time over the combustion engine. It has a real advantage with low pollutant emissions. For example the 80 hp Williams turbine emits 4.5 g/mi carbon monoxide and 0.34 g/mi hydrocarbons. The U. S. Federal Standards for 1976 for these pollutants are 4.7 g/mi CO and 0.46 g/mi hydrocarbons.

24548 **APTIC NO. 45958**

Eickelpasch, Dieter

CARBON MONOXIDE IN STEEL PRODUCTION. *Staub (English translation from German of: Staub, Reinhaltung Luft), 32(2):9-11, Feb. 1972. 1 ref.*

Carbon monoxide formation during various steel production processes is discussed. The open-hearth furnace and the LD processes are described and compared. In the open-hearth furnace, the largest fraction of carbon is introduced by the fuel necessary to maintain the flame for heating the hearth. In the LD process, the carbon content of the pig iron represents practically the whole amount of carbon introduced. The composition of the flue gases of both processes is detailed. The flue gases emitted from the open-hearth furnace are practically free of CO. The LD process involves a CO-free complete combustion operation and a CO-rich suppressed or partial combustion operation. The problem of burning the waste gases of different ignition ranges is of essential importance for reducing CO.

24549 **APTIC NO. 46294**

Elsmlie, Robert G.

FACTUAL STUDIES OF REAL CAUSES OF AIR POLLUTION. *Preprint, Oil Heat Inst. of Washington, 13p., 1971 (?). 16 refs.*

Figures are cited to support the contention that heating oil, either domestic or in combination with industrial heating oil, contributes an insignificant amount less than 2.66 to the total air pollution from all sources in Pierce, King, and Snohomish Counties in the Puget Sound Basin, Washington. Figures on pollutants emitted from the burning of natural gas are given and its conventionally accorded status as a pollution-free fuel is questioned. Potential problems from the contribution of natural gas combustion to significant quantities of atmospheric water vapor are suggested. the most common pollutants from combustion are nitrogen oxides, hydrocarbons, particulates, sulfur oxide, and carbon monoxide. The Ringelman and Bacharach measures of smoke are mentioned.

24550 **APTIC NO. 46048**

Gough, William C.

FUSION ENERGY AND THE FUTURE. *Preprint, Atomic Energy Commission, Washington, D. C., Div. of Controlled Thermonuclear Research, 24p., 1972. 25 refs.*

Man must be supplied with solar energy in the form of ultraviolet rays in order to survive. Fossil fuel and metals have been the real source of man's wealth, and people are in a hurry to deplete these natural resources. The United States stands out in the world with 6% of the world population using about 1/3 of the energy, and becoming dependent on imported materials. The use of energy in the form of fertilizer and pesticides increases the ability to produce food by orders of magnitude. The world population distribution is the inverse of the energy and wealth distributions. About eight billion acres are suitable for agriculture, and only 50% of this is presently under cultivation. The shortage of land for production of food increases. Utilization of metals is increasing more rapidly than the population. Complete depletion of iron will occur in the United States in 93 to 173 years, the latter being an optimistic figure, taking into account reserves multiplied by a factor of 500%. Most materials end up as waste polluting the ocean, the atmosphere, and the land, and there is little recycling. Emissions of carbon dioxide, leading to a world temperature rise, and affecting the ability of the earth to release its heat energy, in fact lead to cooling of the earth, which is not too significant, being incomparable with the sun s energy. The Masschussetts Institute of Technology predicts a drastic drop in the world population during the next hundred years. The MIT model included population, food, pollution, natural resources, military expenditures, capital, and many other factors into its complex diagram. Three possible states the world may go into are considered: a successful transition; the overshoot; and a complete disaster with nuclear war. Different methods of producing energy are discussed. The United States fusion program represents over 15% of the total world program, with an operating budget of $31,000,000 in fiscal year 1972. Actual costs since the program s inception are in the $400,000,000 range.

24551 **APTIC NO. 45392**

Griffith, Wayland C.

POLLUTION CONTROL PROBLEMS OF THERMOPHYSICAL INTEREST. *Preprint, American Inst. of Aeronautics and Astronautics, New York, 6p., 1972. 9 refs. (Presented at the American Institute of Aeronautics and Astronautics, Thermophysics Conference, 7th, San Antonio, Tex., April 10-12, 1972, Paper 72-252.)*

Energy conversion for electrical power, automotive propulsion, and heating generate an impressive array of thermal, particulate, and chemical pollutants. Questions concerning the global energy balance similarly involve processes sensitive to trace impurities present in the atmosphere. A number of problems of atmospheric emission control are identified which either require new knowledge or new applications of existing knowledge from thermophysics as developed for aerospace use. One problem for thermophysics is the world-wide energy balance. The optical characteristics of the atmosphere are determined by its composition and regulate heat exchange between the earth and space. Great interest among the scientific community has focused for years on the balance of energy flux in the atmosphere because the geological record shows recurring warm climatic periods interspersed with ice ages. A model of atmospheric heat exchange is yet to be found to explain what brings about such changes. Transportation, electrical power generation, and space heating as origins of emissions are considered, as well as the use of solar energy for the generation of electrical power. (Author abstract modified)

24552 **APTIC NO. 45810**

Hall, Robert E. and Eugene E. Berkau

A STUDY OF AIR POLLUTANT EMISSIONS FROM OIL-FIRED DOMESTIC HEATING EQUIPMENT. *Preprint, National Oil Jobbers Council, Washington, D. C., 52p., 1972. 3 refs. (Presented at the National Oil Jobbers Council Convention, Washington, D. C., March 7, 1972.)*

The effects of air-fuel stoichiometry, residence time, combustion improving devices, flame retention burners, ignition systems, nozzles, and operating characteristics on burner performance and emissions of carbon monoxide, unburned hydrocarbons, sulfur oxides, nitrogen oxides, smokes, and partiuclates from light-oil domestic heating systems were investigated. Low air-fuel ratios provided maximum efficiency, but emissions were minimized at higher settings. Residence time had a great effect on air pollutant emissions: a longer residence time reduced emissions of smoke, particulates, CO, and HC, but with slightly increased values of NOx. Emissions of CO, HC, smoke, and particulates were significantly reduced by eliminating cyclic based emissions. Burner performance deteriorated over a period of time; in a ten-week period, smoke increased by 5 Bacharach numbers and efficiency was reduced by 10%. Combustion improving devices had little effect on the performance of new burners; only a flame retention device reduced emissions and increased efficiency. Most ignition systems increased NO emissions by about 10% but did not affect other emissions; NO emissions were greatly reduced if the system was automatically shut off after the flame was established. (Author summary modified)

24553 **APTIC NO. 46089**

Hayakawa, Kazuya

AIR POLLUTION IN CITIES AND ITS CONTROL MEASURES. *(Toshi ni okeru taiki osen to sono taisaku). Text in Japanese. Kuki Chowa Eisei Kogaku (J. Japan Soc. Heating, Air-Conditioning, Sanitary Engrs.), 46(6):514-528, June 1972. 4 refs.*

Heating/cooling systems used in buildings are a notable source of air pollution in municipal areas. The present state of air pollution, especially sulfur dioxide in Tokyo and Osaka, the relationship between SO2 and the types of fuel used for the heating/cooling, and methods to reduce such air pollution are discussed. The effective approaches to reducing air pollutants are higher heat insulation and air-tight sealing of a building; use of fuel producing fewer air pollutants; improvement of combustion method; removal of air pollutants from the emission gas; and use of centralized heating/cooling facilities for all buildings in a particular locality or district. The conventional heating/cooling system which is a combination of a heavy oil-fueled boiler and an electric turbo freezer is compared with the electric heating/cooling system from viewpoints of pollution control and operational economy. The problems involving change of heat source from the present one to the new one are discussed. The heating/cooling device of a building is essentially a source of air pollution as long as combustion is involved since combustion gives rise to problem of nitrogen oxides. In this view, a centralized heating/cooling system for a given district will be the most effective in reducing air pollution. Total thermal efficiencies of city gas and electricity when used for cooling and heating are compared with each other to indicate electricity is much advantageous over the city gas.

24554 **APTIC NO. 45732**

Hein, K.

RECENT RESULTS ON THE FORMATION AND COMBUSTION OF SOOT IN TURBULENT FUEL OIL AND GAS FLAMES. *Combust. Sci. Technol., 5(5):195-206, July 1972. 2 refs.*

Experiments were made to determine the reaction rate data in turbulent diffusion flames of industrial size, burning heavy fuel oil, propane, and natural gas. Instrumentation included an improved radiometer, a cyclone sampling probe, and a radiometer which can determine the local extinction coefficient, The influences of primary air, secondary air, and the geometry of the primary duct of the burner on soot production were studied. The formation and combustion of soot, carbon monoxide, carbon dioxide, and hydrocarbons, the quantities of oxidized carbon, solid carbon, and carbon still available in the fuel or as hydrocarbons can be evaluated as a mass fraction of the total carbon available. The activation energy for soot formation can also be estimated.

24555 **APTIC NO. 45681**

Henning, Herbert

THE CALCULATION OF THE PERFORMANCE OF COOLING TOWERS. *(Ueber die Berechnung des Leistungsverhaltens von Kuehltuermen). Text in German. Energie Tech., 24(7/8):241-247. 14 refs.*

Various methods for determining counterflow and evaporative cooling tower characteristics were compared experimentally with regard to simple, accurate routine calculations. The state of the outside air can be largely characterized by the enthalpy of the inlet air, independently of the relative humidity. The Merkel conversion method, permitting measurement series to be evaluated and the design of cooling tower facilities for any thermal condition, is the most practical, provided such factors as the spray density and the cooling zone width are taken into account, and physical relationships between thermal performance, temperature level, and cooling air characteristics are correctly represented. An approximate method, eliminating the air coefficient in the calculation of natural-draft cooling tower, has limited applicability and is unsuitable for calculations for part load conditions. Another difference calculation method, based on Merkel s theory and eliminating the air volume or the air coefficient, is suitable for the calculation of the thermal load cases.

24556 **APTIC NO. 45654**

Ishiguro, Tatsukichi, Isao Koyama, Yoshinobu Iwasaki, Yu Fukushima, Yoshiko Kobayashi, and Toshio Ohira

STUDIES ON ODOR EVALUATIONS IN TOKYO. *(Tokyoto ni okeru akushu no hyoka ni kansuru kenkyu). Text in Japanese. Akushu no Kenkyu (Odor Research J. Japan), 2(7):35-44, Aug. 1972.*

A general discussion on odor evaluation, and the investigations and researches conducted in the Tokyo metropolitan area are given. From 1966 to 1971, the results of research included the establishment of the measurement methods for low boiling substances such as amines, sulfides, and fatty acids, and the successful treatment of odors emitted from a fish meal factory. Comparison of three different sensational test methods for the concentration determination of odor emitted from a chemical plant revealed that results differed from one another. Gas chromatography packed with chemisorb 103 was suitable for the qualitative analysis of amines. Odor concentration of 20,000 ppm at a fish meal factory was reduced to 200 ppm.

24557 **APTIC NO. 46111**

Klee, Otto

PCB IN THE WAKE OF DDT. *(Nach dem DDT das PCB). Text in German. Kosmos (Stuttgart), no. 2:65-66, 1972.*

General ecological problems of the contamination of the environment with polychlorinated biphenyls (PCB) are reviewed. The PCB, emitted by the waste incinerators, or evaporating from paints containing PCB as plasticizer, may be present in the air, since it was actually detected in the air in London and Hamburg in 1966. The PCB, being much more stable than DDT, accumulates in adipose tissues, and attacks the liver. The PCB are able to decompose progesterone, testosterone, and estradiol into water-soluble products which are then eliminated from the organism by the blood and the kidneys. Investigations revealed thin eggshells and teratogenic malformation in fish and birds due to PCB.

24558 **APTIC NO. 45407**

Kobayashi, Hiroshi and Hiroaki Imadani

GAS-FIRING BOILER AS A METHOD OF POLLUTION CONTROL. *(Kogai boshi no tame no gasudaki boira). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(9):47-56, Sept. 1972.*

Gas-burning boilers are discussed including their characteristics, safety standards, and maintenance. The boiler does not generate sulfur oxides, particulates, or other pollutants. It has a wide range of turn down ratio and a larger combustion chamber load. No desulfurization and dust collection apparatuses, spray pumps, or preheaters are needed. The main burner for a gas-burning boiler must be excellent in flame retention so that no blow-off occurs. For boilers with capacity larger than 50 kcal/hr, ignition and fire extinguishing should be carried out at low combustion, and the electric spark of the pilot should be less than 10 seconds.

24559 **APTIC NO. 45387**

Lavrov, N. V. and S. F. Evlanov

PREPARATION OF REDUCING GAS WITH HIGH HYDROGEN CONTENT BY THE PYROLYSIS OF NATURAL METHANE IN MELTS. *(Polucheniye nosstanovitel nogo gaza s nysokim soderzhaniyem nodoroda pirolizom prirodnogo metana v rasplavakh). Text in Russian. Tsvetn. Metal., 45(3):12-14, 1972. 6 refs.*

Natural gas was bubbled through liquid copper, iron, and tin at 1200-1500 C to decompose the hydrocarbons. The hydrogen concentration of the pyrolyzed gas increased with temperature to greater than 90% volume at greater than 1400 C. The pyrolysis degree increased more than the temperature rise than with the decreasing gas flow rate. Addition of an equal volume of steam to natural gas decreased the carbon black formation, but formed approximately 15% carbon monoxide by volume. The results are useful for copper refining with natural gas.

24560 **APTIC NO. 45420**

Lelyuk, V. P., Ye. G. Levkov, and L. A. Fesenko

PHASE CONVERSION OF TARRY PRODUCTS OCCURRING IN GASES EMITTED BY ALUMINUM ELECTROLYSIS WORKSHOPS. *(Fazovyye prevrashcheniya smolistykh veshchestv v otkhodyashchikh gazakh tsekhov elektroliza alyuminiya). Text in Russian. Tsvetn. Metal., no. 4:41-43, 1972. 4 refs.*

Phase conversions of aluminum electrolyzer-generated tarry products were investigated by determining solid-to-gaseous phase ratios at four different points of the waste gas line (electrolyzer outlet after the burner, before the inlet of the collector pipe, as well as before and after the electrostatic dust precipitator). The solid-to-gaseous phase ratios obtained for the first two sampling points at high temperature gradient were equal; increased ratios for the last two points due to the prevalence of condensation over solid phase precipitation were observed. A sharp decrease in the phase ratios at the electrostatic filter outlet was found. The tarry products continued to condense within the electrostatic filter, depending on the temperature gradient. The degree of condensation was a direct function of the temperature gradient near the electrolyzer with burner cut off. Gaseous products were burned by the burner in much higher proportions than solid phase, with corresponding reductions to 1/45 vs. 1/6 of the original amount. Considerable increase in the precipitation in the waste gas pipe with burner cut off was observed. The bulk of the unburned gaseous products has a condensation interval of 70-200 C, which means that electrostatic filters should be operated at 60 C temperature. The residual dust after the electrostatic filter was mainly in a fraction of 0-5 micron; at this point, the content of tarry substances was highest at 27.65%.

24561 **APTIC NO. 45610**

Limaye Dilip R. and John R. Sharko

QUANTITATIVE MODELS IN THE ENERGY SECTOR - A REVIEW OF THE STATE OF THE ART. *Preprint, Inst. of Management Sciences, Pleasantville, N. Y., 59p., 1972. 34 refs. (Presented at the Institute of Management Sciences, International Meeting, 19th, Houston, Tex., April 4-8, 1972.*

Energy demands, supply demand interaction, and measurement of the supply and demand response to prices are discussed. Although the emphasis is on past U.S. studies, national energy models developed in Canada and Europe are also discussed. Two studies performed in the United Kingdom have indicated that national energy models are technically feasible and can be constructed in reasonable time and at reasonable expenditure of resources. These models have also established the reliability of the model building technique for prediction purposes. One of the advantages of the modeling technique is that all the important interrelationships are taken into account, and thus the model provides sort of a self-checking mechanism. Given the assumptions, models will produce reasonably accurate results. The Netherlands model has been accurate to within 3 to 7%, the U.K. model within 3%, and the USSR within 5% of the actual values. The concept of a national energy model for the United States is formulated and the technical and economic feasibility of such a model is discussed. (Author conclusions modified)

24562 **APTIC NO. 45858**

Lukey, Michael E. and M. Dean High

EXHAUST GAS CONVERSION FACTORS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 16p., 1972. (Presented at the Air Pollution Control Assiciation, Annual Meeting, 65th, Miami, Fla., June 18-20, 1972, Paper 72-88.)*

The exhaust gas parameters from 76 combustion and industrial sources are given including fuel combustion processes, refuse incineration, mineral industries, chemical industries, metallurgical processes, pulp mills, and refineries. The main objective of the study was to define a relationship of the exhaust gases being emitted, to the process weights. Each of the 76 industrial source factors includes a process description, the potential air contaminants, operating time, abatement equipment, an input-output relationship, and the exhaust gas parameters: gas flow rate, gas temperature, gas velocity, and stack height. An attempt was made to relate the exhaust gas parameters to an input or output quantity. Thus by knowing the production rate of a plant, one can use these exhaust gas source factors and pollutant emission factors to obtain engineering estimates of specific plant emission and its community inpact through modeling. Sources include coal, oil, natural gas, and wood combustion, incineration; burners; chemical processes such as ammonia, carbon black, chlorine, hydrofluoric acid, paint, phosphoric acid, plastics, ink, soap, sulfuric acid, synthetic fibers, and rubber production; food and agricultural processes; primary metallurgy; steel, lead, zinc, and aluminum production including sintering, blast furnaces, electric furnaces, and open hearth furnaces; petroleum refining, pulp mills; dry cleaning; and surface coating.

24563 **APTIC NO. 46308**

Menkovskiy, M. A., Ye. A. Ivankova, V. T. Yavorskiy, V. F. Mel nik, L. V. Popelyk, and L. A. Androshchuk

HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES. *Sov. Chem. Ind. (English translation from Russian of: Khim. Prom.), 4(3):180-182, March 1972. 1 ref.*

Experiments were conducted to determine the amount of air- and water-polluting hydrogen sulfide formed in an autoclave during the melting of sulfur concentrates, and to study the effect on H2S formation of several variables in the autoclave process. A laboratory unit consisting of a laboratory autoclave, sorption flasks with 5% solution of Cd(CH3COO)2, a suction apparatus, and a batch meter was used. The amount of H2S formed depends on the quality of water used, and increased in the following order of water quality: white, drinking, industrial, distilled, mixture of white water with 15% overflow of thickeners of autoclave melt tails. The yield of H2S can be reduced by paired dosing of the currently used complex of reagents: sodium tripolyphosphate, soda ash, and kerosene. Of the three, soda ash has the greatest effect on H2S formation. The specific yield of H2S is increased with a decrease in the sulfur content of the initial stock. Temperature increment contributes to H2S formation but not to a uniform degree. The yield increases sharply if the melting is conducted above 135 C. The effect of steam feed time was also studied.

24564 **APTIC NO. 46129**

Milliken, Frank R.

COAL AND ENERGY SUFFICIENCY. *J. Metals, 24(8):15-17, Aug. 1972.*

For all its abundance, coal now represents an insignificant part of the fuel used directly for household and commercial heating, virtually none of the fuel used for transportation, and scarcely more than one-quarter of the power and process heat used by industry. Only in electric power generation has coal continued to contribute anything like a major part of the fuel consumed. This disparity has been brought about in part by several actions of the government. One of these government actions has been to encourage natural gas consumption. Federal government sponsorship and promotion of nuclear power have also worked to coal's disadvantage. Finally, and more recently, there have been actions by governments at various levels which restrict sulfur emissions into the atmosphere and, hence, the use of coal and certain other fuels. Despite the longer range value of gasification and liquefaction research, the most important technical work to be done today is in developing systems which would improve the efficiency of converting coal into electrical energy. Fragmented policy-making on energy matters is clearly inadequate today. Energy problems and economic considerations are discussed.

24565 **APTIC NO. 45805**

Nagel, Lester L.

A TOTAL CONCEPT SYSTEM FOR MUNICIPAL WASTE DISPOSAL. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 26p., 1972. 25 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-20, 1972, Paper 72-170.)*

A review of past and present means of waste disposal practices is given, with individual evaluations. A total concept system for municipal waste disposal with two variants is presented, emphasizing the advantages of the second. A cost estimate for total concept systems is made; economic aspects of respective systems and their financial impact on the community are discussed. Landfill, incineration, composting, burning or dumping at sea, sewage treatment, and septic systems, are not sufficient for present needs. An economic evaluation was made of steam and electrical power generation, composting, fertilizer production, land reclamation, and water distillation, aimed at least expensive reclamation of waste material. Water distillation presents interesting possibilities. Both total systems consider combining incineration with heat recovery; mechanical collection with ash disposal; water distillation; and a sewage process unit. Both consider heat recovery and water recovery. The second system is superior because of consolidation of refuse and sewage services at the same geographical location, which results in lower overall initial plant site costs, personnel requirements, and plant operating expenses. Incineration reclaims heat; disposal problems are reduced; auxiliary fuel costs are nonexistant; the electric power purchased costs less than when implant produced; and utilization of all the resultant heat to produce clean water plus elimination of all boiler maintenance on the nonexistent steam boiler. The second system consists of a three-stage incinerator having as the final stage a kiln-type rotating barrel design direct gas-discharge unit. At the temperature of 1800 to 2300 F, stack odor possibilities are eliminated. Cost values are predicted on a single 300 ton/day unit (100,000-population) system. The net annual cost/ton of matter incinerated is $3.25 and $3.16 respectively. These net costs are derived upon the basis of a total of 91,000 ton/yr collected on a 364-day basis and being incinerated on a 345-day (94.5%) schedule of continuous operation each day at an 80 to 85% capcaity level. Costs of removal of incinerated residue as adjacent landfill amount to $1.12/ton. Credit for the distillate water produced has been calculated at the prevailing rate of 30 cents/1000 gal. Present day costs of treated boiler feed-water is in the order of 85 cents/1000 gal. (Author conclusions modified)

24566 **APTIC NO. 46382**

Norden, H.

PROTECTION AGAINST CORROSION IN HEATING SYSTEMS. *(Korrosionsschutz in Heizungsanlagen). Text in German. Oel Gasfeuerung, no. 8:626-627, 1972.*

Corrosion in heating systems is exclusively caused by sulfur compounds which are products of the combustion of sulfur containing fuels. They become corrosive if the temperature drops below their condensation temperature. This type of corrosion is confined to the cold end of the boiler. During the down-time of a boiler, the sulfur oxides adsorbed on soot adsorb moisture. Sulfuric acid is formed which attacks the metals. In order to avoid this corrosion, the heating surfaces must be thoroughly cleaned in small boilers. In larger boilers, installation of the valves might be indispensable. The valves maintain a water temperature in the boiler of 90 C. Apart from raising the water temperature, the entry of unwanted air must be prevented. Minimum waste gas speeds in the stack of 10 m/sec are desirable. For medium-sized boilers fired with heavy fuel oil, a near stoichiometric combustion will help to prevent corrosion by sulfur compounds. If none of the mentioned methods can be applied, additives such as calcium oxide, dolmite, or magnesium oxide must be used for neutralization of the corrosive incrustations.

24567 **APTIC NO. 46177**

Obert, Mark J.

ELECTRIC FARM VEHICLES. ARE THEY FEASIBLE? Agr. Eng., 53(8):26-27, Aug. 1972.

Recent developments of the electric garden tractor and riding mower have demonstrated a viable market for electric farm vehicles. In evaluating the feasibility of an electric farm vehicle, after the battery energy density and configuration are defined, battery charger requirements must be explored. Charger cost is a function of recharge time. The charger must be sized to each specific vehicle mission profile to optimize the cost and recharge variables. The mission profile involves vehicle work requirements, basic power requirements, and charger requirements. To demonstrate the effectiveness of the mission profile analysis in determining the feasibility of electric farm vehicles, an example is given of a mission profile for a riding lawnmower.

24568 **APTIC NO. 45716**

Peranio, Anthony

ELECTRIC POWER AND WATER FOR ISRAEL IN THE 1980 S. *Isr. J. Technol., 10(4):295-305, 1972. 33 refs. (Presented at the Israeli Conference on Mechanical Engineering, 6th, June 1972.)*

Anticipated growth in Israel to the year 2000 is projected at 16,000 MW of electrical generating capacity and 3000 million cu m/yr for total water consumption. Without long-range integrating plans, the consequences may include a serious worsening of environmental quality due to inevitable crowding of the urban centers, siting of the industrial plants in and around the major centers of population, resulting increases in transportation intensity and thus automotive emissions, and increased centralization of other industries, e.g., chemical plants, around power generating centers due to economic factors. Fossil fuels will be easily available for the next 10 years, but thermal, chemical, and siting limitations may inflict restraints. Emissions of sulfur oxides, nitrogen oxides, soot, fine particulates, and hydrocarbons are only partly controlled by fuel desulfurization, scrubbing, electrostatic precipitators, or dispersion from tall stacks, since all the control methods are limited in efficiency or economic feasibility. Nuclear fission reactors for electric power production are increasing, but have other definite limitations. Based on these projections and energy data, a large scale electric power and water scheme is presented. The basic concept is to permit the economic location of electric power and desalination plants in desert areas, with stringent zoning and separation requirements. The operation, construction, design, and economic feasibility of the hydroelectric system, the thermal powered electric generating stations, and desalination plants are examined.

24569 **APTIC NO. 45860**

Platt, Melvin, Khee M. Chng, and E. Karl Bastress

ASSESSING THE IMPACT OF AIRCRAFT EMISSIONS UPON AIR QUALITY. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 27p., 1972. 8 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-166.)*

The methodology used to assess the impact of aircraft emissions upon air quality is described. The method involves selection of airports for analysis, development of a model for the analysis of airport air quality, analysis of existing air quality, future projections of air quality, and proposed control methods. The air quality analysis model describes the emissions at an airport and predicts the resulting concentrations. For modeling purposes, aircract are divided into 12 classes and the aircraft operational cycle is divided into 10 modes. Engine emission data are combined with operational data to obtain aircraft emission factors. Taxi, idle-at-runaway, and take-off and landing emission factors are considered. Aircraft activity levels are then used to calculate aircraft emissions. Emissions of aircraft, as well as other emission sources at the airport, are distributed throughout the airport and its environs. The other emission sources considered are motor vehicles, heating plants, and fuel storage areas within the airport and the airport surroundings. Atmospheric dispersion is based on the empirical double-Gaussian plume solution to the diffusion equation. Both long-term average concentrations and short-term maximum concentrations are considered for comparison with national primary and secondary ambient air quality standards. The anaylsis of existing air quality was based on 1970 activity, while future projections were based on estimated 1975 and 1980 activity. The proposed control methods fall into two categories -- engine modifications and ground operation modifications. Engine modifications are further divided into control methods for turbine and piston engines. The predictions of aircraft emission rates and the resulting concentrations obtained with the airport model are considered to be indicative of the existing situation at the selected airports. These results provide a valid basis for evaluations of the impact of aircraft emissions. (Author abstract)

24570 **APTIC NO. 46093**

Sampson, H. T. and H. J. Killian

EVALUATION OF POWERTRAINS FOR HYBRID HEAT ENGINE/ELECTRIC VEHICLES. *Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1972. 9 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 10-14, 1972. SAE Paper 720194.)*

Hybrid heat engine/electric powertrain configurations were evaluated for several classes of vehicles, five types of heat engines, and three types of batteries. The vehicle applications comprised the family car, commuter car, delivery van, and city bus. Engine types comprised spark ignition, diesel, gas turbine, Rankine, and Stirling, while the batteries were lead acid, nickel cadmium, and nickel zinc. The approach taken was to establish a set of vehicle performance specifications; transform these specifications to hybrid powertrain performance requirements; size the major components of the powertrain; and calculate exhaust emissions over a specific driving cycle for various design concepts, heat engine control schemes, and values for key design parameters. Calculations were accomplished with a computer simulation of the vehicle and powertrain using semiempirical engine exhaust data. Vehicle emissions were relatively sensitive to electric drive motor efficiency and relatively insensitive to battery recharge efficiency. Driving cycle characteristics had a significant effect on theoretical average emission levels. Overall, the hybrid/electric powertrain appears to offer promise as a means of obtaining low emission vehicles compatible with the 1975-1976 Federal Emission Standards. (Author abstract modified)

24571 **APTIC NO. 46121**

Savage, J. D.

THE CONTRIBUTION OF FUTURE VEHICLE POWER UNITS TO THE REDUCTION OF AIR POLLUTION. *Transport Eng. (London), 1972:2-5, April 1972.*

Future power sources as projected control methods for transportation are reviewed. In reference to air pollution and urban planning, alternatives to the gasoline engine are electric cars powered by rechargeable batteries or fuel cells, the Stirling engine, steam engines, rotary piston engines, gas turbines, and hybrid caits (engine-driven electric generator and motor system). Most alternatives will find a definite but limited place in transport. Reciprocating engines will continue to predominate with greater use of rotary piston engines fitted with afterburners and an exhaust gas recirculation system.

24572 **APTIC NO. 45633**

Schaefer, H.

POWER CONSUMPTION AND ENVIRONMENT. *(Energietechnik und Umwelt). Text in German. Brennstoff-Waerme-Kraft, 24(7):280-282, July 1972. (Presented at the World Power Conference, Mannheim, West Germany, March 24, 1972.)*

About 80% of the total power consumption in West Germany is now used for room heating. Dishwashers, washers, and warm water consume a further considerable fraction of power. A washer needs 2.9 kwh for boiling laundry. Of the supplied power, about 14% goes into the air by convection and radiation and 86% is carried off in the waste water. At an annual consumption of about 650 kwh by a washer, about 440 kwh are carried off by the waste water. While so much waste heat is wasted, about 800-1000 kwh are needed in each household/yr for the supply of warm water. While reuse of the wasted heat in households is practicable, it is rather difficult with large thermal power plants. The latter produce too much heat. For example, a 1200 Mw nuclear power plant produces annually 12.7 million Gcal of heat which suffice to supply 340,000 homes with remote heat, i.e., a city the size of Munich. Due to seasonal fluctuations in demand for remote heat, 30% of the heat liberated by power plants can be used annually. For cooling the remaining heat, conventional cooling systems are necessary.

24573 **APTIC NO. 45935**

Schoeppel, Roger J.

PROSPECTS FOR HYDROGEN FUELED VEHICLES. *Am. Chem. Soc., Div. Fuel Chem, Preprints, 16(4):1-11, 1972. 29 refs.*

The potential role of hydrogen as a fuel for mobile power sources is discussed. A rather optimistic outlook for hydrogen is taken based upon a techno-economic assessment of circumstances involving efforts to satisfy society s insatiable demand for energy on the one hand and environmental considerations on the other. This prognostication assumes a reluctance of drivers to give up the degrees of maneuverability to which they have become accustomed and the convenience in personal transportation offered by vehicles of larger horsepower ratings. Recent developments are reviewed which demonstrate that hydrogen fueled internal combustion engines are a practical reality and exhausts from such engines can meet 1975/76 Federal Emission Standards. Problems expected in the evolution, and benefits to be received, are discussed. (Author abstract modified)

24574 **APTIC NO. 46082**

Schuster, Ray

TURNING TURBINES WITH GEOTHERMAL STEAM. *Power Eng., 76(3):36-41, March 1972.*

Geothermal energy is a valuable power source on a regional basis. In northern California, a drilling program for geothermal steams resulted in six productive wells with a capacity of about 300,000 lb/hr of steam at about 115 psig. The steam powers six generating plants with a total geothermal capacity of 302 mw at an average total generating cost of less than 6 mills/kw/hr. The noncondensable gas in the steam consists primarily of carbon dioxide, which averages a little over 80% by weight of the total. Other gases present in small quantities include methane, hydrogen, nitrogen-argon, hydrogen sulfide, and ammonia. Steam pressures specified for gas ejectors were 50 psig for 65 psig turbines and 80 psig for 100 psig turbines. Large steam lines and larger quantities of cooling water are required because of the low steam pressure and its corresponding low temperature. The steam wells have a shutoff pressure of 450-480 psig, resulting in an optimum turbine inlet temperature of about 135 F, with an assumed turbine generator efficiency of 75%. The geothermal steam is slightly superheated. No makeup water is required for the cooling tower evaporation as the steam condensate provides more than requirement of the cooling tower. Because of the atmospheric differences between day and night, better turbine vacuum is obtained at night when the cooling tower is more effective. A load-limiting device senses the generator load and maintains it at a present level. The hydrogen sulfide in the steam is corrosive to bare copper, particularly in damp conditions. Therefore, most auxiliaries at the power plant are motor-driven to avoid the complications of the corrosion of turbine-driven equipment. Drilling continues in favorable areas to obtain geologic information and to investigate the geothermal energy potential.

24575 **APTIC NO. 45777**

Smith, Malcolm and Michael J. Manos

DETERMINATION AND EVALUATION OF URBAN VEHICLE OPERATING PATTERNS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 30p., 1972. 11 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-177.)*

Data collected in five major metropolitan areas were combined to form an overall composite of urban driving patterns. Three vehicles, instrumented with digital data acquisition systems, were operated as chase cars and emulated the driving patterns of various cars representing the traffic population. Vehicle speed, manifold vacuum, and time of day, together with identification and environmental data, were recorded on magnetic tape for computer processing. Vehicle operating modes were classified as accelerations, decelerations, cruises, and idles. Mode characteristics, such as frequency of occurrence, total duration, average duration, and transition probability, were defined in matrix form. Modal data were supplemented by average trip speed and acceleration-deceleration profiles. A set of 17 evaluation measures, used to determine driving pattern similarities between cities and the pattern variability within a city, revealed both similarities and differences between driving patterns in Los Angeles, Houston, Cincinnati, Chicago, and New York. Los Angeles showed the fastest overall average speed of 29.34 mph, and New York City has the lowest average speed, 21.33 mph. Similarly, Los Angeles drivers spent the least amount of time at idle, 10.13%; New York City had the highest value, 17.45%. The typical acceleration and deceleration speed-time profiles are essentially the same for the five cities.

24576 **APTIC NO. 46185**

Thomsen, Dietrick E.

MHD: HIGH PROMISE, UNSOLVED PROBLEMS. *Sci. News, 102(9):138-140, Aug. 1972. 3 refs.*

Magnetohydrodynamics promises to provide power from fossil fuels with less pollution and greater efficiency than conventional steam plants The idea of MHD power generation is to replace the metal elements that conventional generators use to produce a current with hot electrically conducting gases. In an

MHD generator the metal armatures are replaced by a very hot conducting gas. The motion of this gas across a magnetic field causes its charges to form a current, and the current is collected by electrodes at the sides of the chamber in which the current is made. The MHD generator omits two energy losing parts of the conventional cycle: making steam and turning a turbine. Development of MHD power generation in the United States is described, including problems associated with this method of power production. A 25-megawatt plant called U-25 has been built in the USSR. As in all cases where coal is burned, nitrogen oxides and sulfur oxides will be produced and must be dealt with. Coal gases and natural gas can also be used as fuel. Proponents of MHD believe that, in part due to the higher operating temperatures, methods for removing pollutants can be developed that will be more effective than those used in conventional plants. The high temperature means less thermal pollution.

24577 **APTIC NO. 46166**

Thornton, D. P., D. J. Ward, and R. A. Erickson

MRG PROCESS FOR SNG. *Hydrocarbon Process., 51(8):81-84, Aug. 1972. 1 ref.*

The Methane Rich Gas (MRG) process is a catalytic steam-reforming process similar to the classical synthesis gas reaction. The MRG Process is a low temperature process, thermodynamically balanced, so that no heat is supplied beyond bringing reactants to reaction temperature. Unlike the synthesis gas reaction, the product is either a 600 Btu/stand. cu ft or a 100 Btu/stand. cu ft gas rich in methane. Process reactions, economics, and commercial units are described. Gasification of liquid hydrocarbons over a catalyst to form methane, hydrogen, and hydrocarbons is the heart of the MRG process. The fuel oil is desulfurized by hydrodesulfurization prior to gasification.

24578 **APTIC NO. 46191**

Thur, George M.

THE FEDERAL GOVERNMENT APPROACH TO DEVELOP AUTOMOTIVE GAS TURBINES. *Gas Turbine Int., 13(4):31-36, July-Aug. 1972.*

In early 1970, the President announced a federally sponsored program of research and development to develop alternate power systems for automobiles in the event that industry cannot adequately clean-up the conventional engine to meet the forthcoming standards. This research and development program together with a parallel program to provide financial incentive to industry for their development of alternate systems are included in the Advanced Automotive Power Systems Program of the Environmental Protection Agency. In the AAPS program there are three categories of candidate power systems competing for development: gas turbine systems, Rankine cycle systems, and the Stratified Charge Systems. Application of the turbine has been considered for military vehicles, trucks, and buses, but only one automotive company has made demonstration scale use of the gas turbine in a family sized automobile. The development approach to gas turbine engine technology, basic problems, the baseline engine program, development of low emissions combustors, gas turbine cost evaluation, and optimum configuration studies are discussed. The turbine exhaust is low in hydrocarbons and carbon monoxide. In addition particulates can be easily controlled. Nitrogen oxides can be reduced by catalytic and flame afterburners, and changing temperature and combustion air amounts.

24579 **APTIC NO. 46184**

Turk, Amos

ODOR SOURCE INVENTORIES. *Pollut. Eng., 4(5):22-24, Aug. 1972.*

An inventory of odor sources may be used to predict the scope of odor control procedures needed for abatement, to relate odor sources to effects in the community, or to establish regulatory or enforcement policies. If it is assumed that different odor sources cannot be measured on an equal basis, then consideration must be given to the role of odor qualities. Odor quality classification systems are described, and a procedure is presented for translating quality descriptions into inventories of odor sources. Another method is based on the premise that a sample of odorous air can be described in terms of the volume to which it must be diluted for its intensity to be reduced to the sensory threshold level. Sources include foundries, bakeries, rendering, surface coating, petroleum refining, dry cleaning, and diesel engines. Organic nitrogen compounds, phenols, organic sulfur compounds, organic acids, solvents, and naphthalene are major odorants. Social and economic effects of odors are mentioned. (Author abstract modified)

24580 **APTIC NO. 46136**

Turrel, John D.

ELECTRICAL ENERGY: POTENTIALS IN PRODUCTION PROCESSING RECYCLING. *Agr. Eng., 53(8):13-15, Aug. 1972.*

Agriculture is a dealer in large masses of matter that are not used up instantaneously, such as the moisture in a field or the feed supply for a large number of animals. For this reason, agriculture has some unique possibilities for the storage of energy that might be applied at off-peak times, to the economic benefit of the farmer and electric power supplier and to the environmental benefit of society. Because many agricultural jobs require single-speed rotation, the basic one-moving part simplicity of the electric motor is coming increasingly to the fore. Maintenance is near zero, life is long, and often the energy cost is less. Advantages of electrical energy for the environment, space heating, process heating, lighting, propulsion systems, and various devices are indicated.

24581 **APTIC NO. 46380**

Vandenbulcke, Gilbert

PLASTICS AND THE ENVIRONMENT. *(De plastics in het leefmilieu). Text in Dutch. Plastica, 25(8):348-354, Aug. 1972. 20 refs.*

General aspects of plastics wastes are reviewed with regard to the incineration of domestic refuse. The share of plastics in the domestic refuse is rather small and will remain so for a considerable time. The proportions of polyethylene, polystyrene, and polyvinyl chloride in the domestic wastes in Belgium are 1.7%, 0.3% and 0.2%, respectively. Polyethylene, polystyrene, and polyvinyl chloride cause carbon monoxide emissions during incineration, while polystyrene also emits soot, and polyvinyl chloride emits hydrochloric acid. Other components of domestic waste generate HCl emissions. Hydrochloric acid present in the incinerator waste gases causes corrosion in a reducing atmosphere, by converting the iron oxides usually present on steel surfaces into volatile iron chlorides, while no attack in oxidative atmosphere is possible. Scrubbers can remove up to 85% of the HCl from incinerator waste gases. In general, waste incineration generated emissions, including HCl, have a minor contribution to global air pollution. Plastic wastes subjected to vacuum distillation yielded condensable gases suitable for use as fuel.

24582 **APTIC NO. 45613**

Wendell, R. E.

ENVIRONMENTAL ASPECTS OF URBAN TRANSPORTATION PLANNING. *Preprint, Operations Research Society of America, Baltimore, Md., 33p., 1972. 8 refs. (Presented at the Operations Research Society of America, National Meeting, 41st, April 1972.)*

In conjunction with the Clean Air Act, a model was developed for analyzing the transportation pollution problem in Chicago. It consists of a vehicle emissions model, a transportation model, an emission map model, a stationary combustion model, and a dispersion model. The vehicle emissions model plays a central role in the overall approach. In this total systems approach grids are defined over the region of interest. Each grid box contains the corresponding data concerning transportation characteristics. They include daily and peak hour miles for each of various classes of vehicles (passenger cars, light-duty trucks, heavy-duty trucks) over various classes of roads (arterial, freeway), respective average speeds, and the number of various kinds of trip origins (home to work, work to home, other). The purpose of the urban transportation model is to provide such data for not only the present and target years, but also to simulate possible transportation control strategies. The vehicle emissions model gives the emission rates in g/mile and g/origin of carbon monoxide, nitrogen oxides, and hydrocarbons. These rates depend on factors such as local registration data, car/truck mix, and speed. Distinction is made between cold and hot emissions of engines. The curtail strategy eliminates 50% of the home to work trips from outside the CBD to inside the CBD, and results in a 33% emission reduction in the CBD under the cold/hot emission distinction. When the distinction is not made, the reduction is only 25%. Regional characteristics have to be differentiated. Federal auto registration data for Chicago, Cook County, and Illinois are compared. Chicago has a higher proportion of newer cars. This means that the effects of the Clean Air Act will have an earlier and bigger impact on auto manufacturers in Chicago. The model can also estimate the effect of inspection/maintenance systems. (Author conclusions modified)

24583 **APTIC NO. 46332**

Wendell, Richard E.

POLLUTION CONTROL STRATEGY EVALUATION OF URBAN TRANSPORTATION SYSTEMS. *Preprint, Inst. of Management Sciences, Pleasantville, N. Y., 30p., 1972. 10 refs. (Presented at the Institute of Management Sciences, International Meeting, 19th, Houston, Tex., April 4-8, 1972.)*

To attain safe air quality levels each major urban area must develop a pollution control strategy. A total systems approach in analyzing the alternatives of parking restrictions, staggered work hours, promotion of mass transportation, commuter taxes, and gasoline rationing, is presented. It is based on a vehicle emissions model and an urban transportation model. It includes also an emission map model, a stationary contribution model, and a dispersion model. The vehicle emissions model distinguishes between hot and cold vehicle operation. A spacial breakdown of the region is made, by subdividing the region into a number of grid boxes of the same sizes. Smaller boxes correspond to areas of more concentrated activity. Transportation characteristics are obtained for each box. They include daily and peak-hour mileage estimates, speed estimates, and data on origins and destinations. Emission rates for vehicles are estimated independently. Distinction is made between hot and cold emissions. By combing the emission rates and the transportation data for each grid box, emissions for each box in any year are estimated. The Chicago Area Transportation Study (CATS) has a very large and detailed model of the region. In cooperation with CATS daily and peak-hour data were obtained for every grid box, concerning total arterial mileage and average arterial speed; total freeway mileage and average freeway speed; the number of work-to-home origins; and other origins. By considering the home-to-work origins as cold starts, the work-to-home origins as 9/10 of a cold start, and by letting all other origins be 1/2 of a cold start, the total number of equivalent cold starts can be readily calculated for each grid box.

24584 **APTIC NO. 46300**

Williams, Laurence O.

THE CLEANING OF AMERICA. *Astronaut. Aeronaut., 10(2):42-51, Feb. 1972. 29 refs.*

For a permanent solution to air pollution, the open-loop combustion of fossil fuel must stop. Only nuclear power can do this. However, while minimizing air pollution, it would worsen thermal pollution. Placing the nuclear generating plants in the oceans would avoid thermal pollution at the expense of situating them too far from many users for economic power transmission. Only hydrogen of the chemical fuels could be used for mobile power and for generating electric power away from the coasts without any pollution. Hydrogen provides more energy per unit weight than any other fuel. It and its combustion products, hydrogen and water, are totally non-toxic. These two nonpolluting sources of power, nuclear reactors and hydrogen combustion, can supply practically all the nation s energy. As an additional benefit, the system would produce enormous quantities of pure oxygen for depolluting our lakes and rivers. A system is proposed to locate large nuclear powerplants in the oceans producing both electrical power and hydrogen. The hydrogen would fuel inland powerplants and mobile power sources and satisfy other energy demands. The technical realities that lead to such a system are considered.

24585 **APTIC NO. 46188**

Willis, G. H., J. F. Parr, S. Smith, and B. R. Carroll

VOLATILIZATION OF DIELDRIN FROM FALLOW SOIL AS AFFECTED BY DIFFERENT SOIL WATER REGIMES. *J. Environ. Quality, 1(2):193-196, 1972. 19 refs.*

Dieldrin volatilization from fallow soil was evaluated using an aerodynamic method for estimating flux, and the effect of different soil water regimes on dieldrin volatilization was investigated. The ultimate fate of certain chlorinated hydrocarbon pesticides in the environment has been the subject of considerable research effort in recent years. Compounds such as dieldrin tend to accumulate in soil because of their relative resistance to degradation through either chemical or microbiological processes. Dieldrin was surface applied at a rate of 782 g/plot to three 15.2 by 22.9 m plots. Immediately after application, one of three soil water regimes (flooded, moist, nonflooded) was imposed on each plot. An air sampling system was used to measure the atmospheric concentration gradient of dieldrin between 10 and 30 cm above each plot. Calculations based on the aerodynamic method indicated that approximately 18% of the applied dieldrin volatilized from the moist plot in 5 months, whereas only 2 and 7% volatilized from the flooded and nonflooded plots, respectively. Multiple regression analysis indicated that of the climatic variables measured, temperature had the greatest effect on dieldrin volatilization. (Author abstract modified)

24586 **APTIC NO. 46094**

Wright, E. S., W. R. Davison, and L. E. Greenwald

A FEASIBILITY ANALYSIS OF A SIMPLE CYCLE GAS TURBINE ENGINE FOR AUTOMOBILES. *Preprint, Society of Automotive Engineers, New York, 12p., 1972. 18 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 10-14, 1972, SAE Paper 720238.)*

The feasibility of a simple cycle gas turbine engine for automobiles is analyzed by means of comparison with internal combustion engines for automobiles. Applicable technology is reviewed with emphasis on centrifugal compressor technology, which has demonstrated pressure ratios of better than 10:1. The design of a simple cycle 150 hp automobile engine based on these components is presented, together with estimated torque and fuel flow characteristics for the entire range of possible engine performance, derived from engine cycle analysis programs. Results of a vehicle performance computer program designed to evaluate candidates for this application include time/speed/distance performance estimates for maximum acceleration as well as fuel economy and emissions estimates for pertinent driving cycles. Summaries of manufacturing cost estimates are presented for several candidate gas turbine engines. A speculative overall cost for both four and ten years of owership is estimated based primarily on these fuel economy and manufacturing cost derivations. (Author abstract modified)

24587 **APTIC NO. 45691**

Yamaguchi, Takaaki

A GRASP OF AIR POLLUTANT EMISSION QUANTITY AT THE EMISSION SOURCE -- METHOD AND EXAMPLES OF TOTAL EMISSION CALCULATION. *(Taiki osen busshitsu haishutsuryo no hasseigen ni yoru haaku - haishutsuryo soryo santei no hoho to sono rei). Text in Japanese. Kagaku kojo (Chem. Factory), 16(8):82-86, Aug. 1972.*

A method for calculating total emissions by means of air pollutant emission factors is described. Emission sources are classified into 10 categories by the U. S. Environmental Protection Agency, and the emission factor of an individual pollutant is determined on the basis of fuel consumption, plant capacity, gross production, etc. For instance, the nitrogen oxides emission factor at a power plant is much higher due to the high-temperature boiler. On the other hand, emission factors of other pollutants such as carbon monoxide and hydrocarbon, are lower compared to other combustion facilities. Nitrogen oxides and hydrocarbon emissions in the Tokyo metropolitan area were calculated using EPA emission factors. Approximately 39% of the NOx resulted from power plants and 30% from automobiles. About 44.6% of the hydrocarbons resulted from automobiles and 24% from petroleum refineries.

1971

24588 **APTIC NO. 45520**

Society of Automotive Engineers, Inc., New York

AUTOMOTIVE GASOLINE. *SAE Rept. J312b, Nov. 1971. 24 refs.*

The significance of the more important physical and chemical characteristics of automotive gasolines is summarized, and pertinent test methods for defining or evaluating these properties are described. Grades of gasoline; antiknock quality; volatility; other properties such as workmanship and contamination, sulfur content and copper strip corrosion, existent gum and stability, gravity, rust and corrosion, and hydrocarbon composition; additives; and special test fuels are discussed.

24589 **APTIC NO. 45609**

Georgia Kraft Co., Rome, Ga., Research and Development Center

TREATMENT OF SELECTED INTERNAL KRAFT MILL WASTES IN A COOLING TOWER. *Environmental Protection Agency Grant WPRD 116-01-68, Program 12040EEK, 157p., Aug. 1971. 28 refs. (p.47-67 directly concerns air pollution.)*

GPO

A full-scale cooling tower for reducing oxygen-demanding wastes was tested. The tower was unique since both cooling and waste water treatment had to be considered. The tower had to meet basic cooling design requirements to provide cooling water for use in barometric condensers if it was to serve its major function in the water reuse system. Air stripping was the principal treatment mechanism. Physical limitations of the tower structure and the operating expense of moving large volumes of air made it necessary to compromise treatment with cost. A liquid-to-air ratio as low as 1.2 could be used. Laboratory tests showed that the methanol removal corresponded to essentially the same percentage reduction in volatile Basic Oxygen Demand (BOD). The occurrence of foam was a major problem. The cooling tower evaporator system could operate in many modes with various waste streams in or out of the system. The waste streams being treated contain organic sulfur compounds which are responsible for odors associated with kraft pulping. Emissions from the cooling tower include sulfur dioxide, hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. However, no noticeable odor problems were associated with the cooling tower, due to dilution and dispersion of the stack gases. Process modifications could further reduce sulfur emissions. The cooling tower removed 25-30% of the organic pollution discharged from the mill. The installation cost of the cooling tower was $239,000. The cost of surface condensers is estimated to be $229,000.

24590 **APTIC NO. 45534**

Allen, Eric R.

THE CHEMISTRY OF AEROSOLS. *Preprint, American Chemical Society, Washington, D. C., 27p., 1971. 49 refs. (Presented at the American Chemical Society, National Meeting, 161st, Los Angeles, Calif., March 28-April 2, 1971, Paper 71-122.)*

General reasons for current interest in atmospheric aerosols are presented. Industrial processes are the prime source of particles in urban areas and a major source of sulfur dioxide which may be readily converted to particles. Improvement in the collection efficiency of particles in stack gases by combining electrostatic precipitators with mechanical collectors and by the replacement of older power plants is expected to decrease the annual emission of 2.4 million tons for 1965 to 1/3 of this value by 1980. The total concentration of particulate matter in polluted atmospheres is higher than the natural organic aerosol background of 3 to 6 micrograms/cu m by factors between 10 and 100. Techniques used for the study of collected atmospheric particles include impaction on glass slides and visual inspection by optical microscopy, bulk analysis by extraction from filters, and conventional microchemical techniques used in determining the composition of solute. Wet chemical microanalysis includes automated colorimetric methods for anions and atomic absorption spectrophotometry for cations. The study of individual particles employs the techniques of scanning electron microprobe analysis. Continuous nationwide surveillance of airborne particles in major metropolitan, urban, and rural areas has been undertaken by the National Air Sampling Network since 1953 with analyses being made of the weight concentration of particles, the organic benzene-soluble portion, and gross radioactivity. The nature of atmospheric aerosols associated with urban pollution is discussed with regard to categories on chemically inert, organic, and sulfuric acid aerosols and inorganic salts. The transport of aerosols is mentioned along with photochemical reactions.

24591 **APTIC NO. 45368**

Dvornikov, A. G.

MERCURY IN DONBASS COALS. *(Rtut v uglyakh Donbassa). Text in Russian. Priroda, 71(7):82, 1971. 2 refs.*

Facts on the presence of mercury in Donbass and other coals as well as in residues and coke gas are presented. Mercury in the soot from a Donbass coal-fired boiler (41 g/t), in coke gas, and metallic mercury in light oil separators and collectors of the tar distiller at a cokery were found. Investigations of the mercury distribution in different cokery products revealed that 40-50% of the total mercury present in coals was retained by rocks and waste gases, and the rest present in the charge (0.1 g/t) passed into the coke gas. Mercury content in tars, particularly their low-boiling fractions, reached values of 2 g/t. Mercury in charges of several cokeries was detected. Five different grades of Donbass coal contained 2, 1.47, 1, 0.7, and 0.42 g of mercury per ton. A certain proportion of mercury present in coal is in connection with pyrite, while the bulk is in the form of sulfide. The removal of mercury from coke gas and tar appears feasible.

24592 **APTIC NO. 45381**

Forizs, Stefan

SULFUR AND VOLATILES BEHAVIOR DURING COKING AND THEIR DISTRIBUTION OVER THE VARIOUS GRAIN-SIZE CLASSES OF COKE. *(Comportarea sulfului si a materiilor volatile in procesul de cocsificare si repartizarea lor in cocsuri pe diferite clase granulometrice). Text in Rumanian. Metalurgia (Bucharest), 23(12):767-772, 1971. 9 refs.*

The formation of cracks in coke and the movement of volatile matter and primary compounds of sulfur to the wall of coke furnace, in counterflow with the heat flow, was studied. The maximum sulfur concentration occurred in the intermediate zone of the maximum condensation of coke, where the mechanical resistance and compressive resistance are maximal. The temperature gradient and the end temperature of coking determine the grain-size distribution, the volatile matter content, and sulfur content in coke. With raw coke containing more than 0.6-1% volatile matter and 0.2-0.3% more sulfur than normal cokes, the specific coke consumption in the furnace increased by 60-80 kg/t. When geologically recent coal was coked, the thermal stabilization process was continued so that the cracks were formed in the coking furnace with a simultaneous reduction of sulfur and volatile matter content and an improvement of coke quality. Mechanical stabilization gives only a possible improvement of the mechanical properties of the coke and a new distribution of sulfur in the new grains formed, without improving the physical-chemical properties of the coke. It is necessary to reconsider the sampling methods and the methods for determining the various properties of metallurgical coke.

24593 **APTIC NO. 45556**

House, Charles

STATEMENT OF CHARLES HOUSE, MEMBER COLORADO AIR POLLUTION COMMITTEE. *In: Problems of Electrical Power Production in the Southwest. Part 4, 92nd Congress (Senate), 1st Session, p. 1138-1141, 1971. (Hearings before the Committee on Interior and Insular Affairs, May 27, 1971.)*

GPO

Emission from coal-fired power plant complexes in the Four Corners region of the Southwest will markedly worsen a situation which, according to emphysema death rate statistics, is already undesirable. An estimate of daily emissions of sulfur dioxide from all sources in the State of Colorado, roughly equal in size to the Four Corners Air Quality Control Region, is about 10% of the anticipated 2150 tons/day to be released from the stacks of the coal-fired plants in process. Compared to the Four Corners region, the six county area of Southern California, which is affected substantially by the Los Angeles pollution, with an area about 40% the size of the Four Corners area, has approximately equal emission of nitrogen oxides, one-seventh the SO2, and one-third the particulates. The particulate emissions in the power plants are planned to be controlled to the best that modern technology can achieve. With this control, the particulate emissions are to be held to about 250 tons/day; without controls, they would total several thousand tons/day. However, those 250 tons of submicron size particles will be much more dangerous to health than an equivalent tonnage of particulate emissions from a major city where control equipment is not as efficient. Even without the addition of pollution from the Four Corners complex, Colorado anticipates pollution problems of its own from the additional 750 megawatts of coal-fired power necessary to meet power demands by 1985. The worst 10 states in emphysema death rate in the 1960s were Arizona, Colorado, Florida, Montana, Wyoming, Idaho, Vermont, Nevada, Oregon, and Kansas. The highest death rate counties in Colorado are concentrated in the mountainous central portion of the state, where the economy is usually based on mining and ore reduction processing or on lumbering. These counties also have their major town or two set in a mountain valley or bowl ringed by much higher mountains.

24594 **APTIC NO. 45570**

Newman, D. J. and L. A. Klein

RECENT DEVELOPMENTS IN NITRIC ACID MANUFACTURE. *Preprint, American Inst. of Chemical Engineers, New York, 30p., 1971. 13 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 64th, San Francisco, Calif., Dec. 2, 1961.)*

Commercial efforts to reduce the emissions of nitrogen oxides and the loss of catalysts in the production of nitric acid are reviewed. The main features of the Hycon process for the manufacture of nitric acid are presented. The critical steps include cooling the process gas in a refrigerating condensor prior to its entrance into the final absorber, passing the uncondensed gases to the main absorber for final recovery, and stripping the nitrogen oxides from the highly concentrated condensate. The gas from the stripping process is directed to the enriching tower where, by countercurrent contact with some or all of the acid produced in the main absorber, a product containing 80% acid is formed. Further concentration of this product is possible and other modifications of the patented process are outlined. Nitrogen oxides emitted by this process can be eliminated by catalytic reduction or oxidation, absorption, or adsorption.

24595 **APTIC NO. 45461**

Smith, William M.

EVALUATION OF COKE OVEN EMISSIONS. *J. Occup. Med., 13(2):69-74, Feb. 1971. 1 ref. (Presented at the American Iron and Steel Institute, General Meeting, 78th, May 28, 1970.)*

In 1965 the American Conference of Governmental Industrial Hygienists adopted a tentative threshold limit value for employee exposures to the benzene-soluble fraction of coal tar pitch volatiles. Comparison of glass fiber, cellulose acetate membrane, and silver membrane filters for the collection and measurement of the benzene-soluble fraction, made by the State of Pennsylvania, established that silver membrane filters were most effective. The sampler and methods of collection and analysis are described. An American Iron and Steel Institute research program evaluated the efficiency of silver membrane filters, and an attempt was made to determine the composition of the benzene-soluble fraction with particular emphasis on polynuclear aromatics. A six-man survey team was organized by AISI to go to Germany to investigate the effectiveness of the different types of control equipment installed at various coke plants in the Ruhr Valley. An accelerated respiratory protection program is described, and results are given of extended research on the characterization of coke plant emissions. The design and testing of a powered air purifying respirator for coke oven workers are considered, as well as the criteria for the threshold limit value for coke oven emission.

24596 **APTIC NO. 45442**

Tihansky, Dennis P.

POLLUTION CONTROL IN STEEL MAKING: FACT OR FICTION? Rand Corp., Santa Monica, Calif., Rept. P-4552, 6p., Jan. 1971. 10 refs.

NTIS: AD 731262

The progress of the American steel industry in its research and consequent air control programs is examined. The steel industry is one of the major waste generators in the United States. Public concern about steelmaking waste has increased considerably after World War II. Because of the huge volumes and diversity of pollutants generated in steel making operations, large, complex, and expensive control devices must be maintained to comply with laws enforcing high standards of atmospheric and river quality. Steelmaking wastes differ greatly in size, composition, and characteristics depending upon the particular phase of production. The major pollutants include particulates and dust in flue gases, sulfur dioxide, sulfuric and hydrochloric acid pickling mists, nitrogen oxides, hydrogen sulfide fumes, lead, fluorides, carbon monoxide, and carbon dioxide. The individual steel firm generally reacts to anti-pollution enforcement either by maintaining planned production levels and raising prices, curtailing pollution levels, increasing efficiency, process modifications, or by capturing and utilizing or selling waste by-products. Installation, operation, maintenance, and repair costs of waste control facilities are considered.

CONTROL METHODS

1972

24597 **APTIC NO. 45359**

(Inventor not given.)

RECOVERY OF SULPHUR DIOXIDE FROM WASTE GASES. *(Wellman-Power Gas Inc., Lakeland, Fla.) Brit. Pat. 1,261,199. 13p., Jan. 26, 1972. (Appl. Nov. 11, 1968, 11 claims).*

Sulfur dioxide may be recovered from SO2 containing gases using an aqueous solution of sodium, lithium, or beryllium sulfite. A conventional process for SO2 recovery from gases containing large concentrations, i.e., 5-20 % weight SO2, by cooling and scrubbing the gas with water which dissolves the SO2 and then heating the resulting solution to drive off the SO2 requires large quantities of water and fuel and is correspondingly expensive and generally unsuitable for use with gases containing small concentrations of SO2. A modified process provides for the recovery of SO2 present in small and large concentrations in gases; greater than 75 % weight can be removed from such gases. The SO2 is separated from the gas by contacting it with an aqueous solution of sodium, lithium, or beryllium sulfite at a temperature at which the SO2 and water and sulfite may react to yield the bisulfite and below the temperature at which the bisulfite decomposes to the sulfite, to produce an aqueous solution containing unreacted sulfite and the corresponding bisulfite. The dissolved sulfite is removed by crystallization or by other means, separating the sulfite from the bisulfite in solution; the bisulfite is then decomposed and is converted into gaseous SO2, water, and the corresponding sulfite. The SO2 is drawn off and can be either cooled and compressed to provide a liquid product or sent as a gas to a sulfuric acid plant. The sodium sulfite may be recycled to the reaction zone where additional SO2 is absorbed. The process is applicable to SO2 recovery from smelter gases, chemical plant emissions, coal-fired furnace gases, and power plant stack gases.

24598 **APTIC NO. 45428**

BLANCHARD SAVES $42,000 ON ECOLOGY. *Text. World, 122(8):33, Aug. 1972.*

A new type of incinerator, based on the starved air principle, installed at a Blanchard Yarns plant in Whitaker, North Carolina, not only improves solid waste disposal, and generates emissions 1/2 of those permitted by law, but it also will pay back in 1 year and 9 months, and later will bring savings as high as over $40,000/hr by eliminating labor costs, transport to dump, or compaction of the 10,000 cu yd/mo of solid waste generated. The usual concept of combustion is reversed by holding back on air rather than force excess air into the fire. This has the effect of promoting a less turbulent, more even burning process which drives off gases that can then be burned -- along with the smoke -- at a higher temperature in the secondary chamber. It is there that natural gas is introduced to ignite the combustible gases from the burning charge in the primary chamber. The fire temperature helps regulate the rate of air intake. With this design, there is no need for scrubbers, precipitators, or other add-on devices used to control fly ash emissions. It also eliminates the use of heavy-duty air blowers to force air through a complex smoke-cleaning system. Since air is introduced through the bottom of the primary chamber, there is no need for grates, another source of trouble in many incinerators. The incinerator costs $35,000.

24599 **APTIC NO. 45455**

(Inventor not given.)

IMPROVEMENTS IN OR RELATING TO THE REMOVAL OF ACID GASES FROM GASEOUS HYDROCARBON-CONTAINING EFFLUENTS. *(Lummus Co., Bloomfield, N. J.) Brit. Pat. 1,261,609. 7p., Jan. 26, 1972. (Appl. Oct. 13, 1969, 16 claims).*

An improved process is described for removing acid gases from a gaseous hydrocarbon-containing effluent which includes both dienes and acid gases. The gaseous effluent if contacted in an absorption zone with an aqueous amine solution to effect removal of the acid gases, and the dienes are also carried from the gaseous effluent into the aqueous amine solution. The aqueous amine solution which contains both acid gases and dienes is mixed with a hydrocarbon solvent essentially free of olefinically unsaturated components. The mixture is separated into a hydrocarbon phase containing essentially all of the dienes and an aqueous amine phase. An aqueous amine solution essentially free of dienes is recovered. In previous processes, serious polymerization problems were encountered in the amine regenerator and heat exchange system due to the heat sensitive dienes present in the pyrolysis effluent gas being carried into the amine absorption system.

24600 **APTIC NO. 45463**

NEW SOLUTION TO SOLID WASTE DISPOSAL PROBLEM. *Heating, Piping, Air Conditioning, 1972:31-32, Aug. 1972.*

A plant designed to convert municipal refuse into chilled water and steam will solve the problem of solid waste disposal for the city of Nashville, Tennessee. In spite of its downtown location, the plant will actually reduce air pollution in the city, and it will offset the cost of incineration by paying its own way through the production of steam and chilled water. Use of solid wastes as fuel will effect significant savings in the use of fossil fuels. Because most of the individual systems being replaced are powered by electricity, more than 71 million kw-hr will be saved annually. Use of a variable volume of combustion air in the incinerators will provide a furnace temperature of about 1800 F despite the uneven burning qualities of solid waste, providing for efficient disposal of refuse while keeping temperatures below 2000 F at which nitrogen fixations can begin to occur. Auxiliary burners and over-air combustion will completely burn smoke particles so that fly ash will be the only particulate matter leaving the combustion chamber. Dry cyclone collectors will then remove particles above 10 micron in size, while the remaining particulates and gaseous pollutants will be treated in three-phase wet scrubbers. Advantages and other details of this type of incineration are indicated.

24601 **APTIC NO. 45638**

(Inventor not given.)

PROCESS FOR RECOVERY OF SO2 FROM WASTE GASES. *(Wellman-Power Gas Inc., Lakeland, Fla.) Brit. Pat. 1,261,198. 24p., Jan. 26, 1972. (Appl. Nov. 11, 1968, 24 claims).*

A process is provided for removing sulfur dioxide from a gas stream which contains SO2 and sulfur trioxide at a temperature between 160 and 800 F. The gas stream is first treated to remove the SO3. Then, the treated gas stream is contacted with an aqueous absorbing solution of metal sulfite to absorb SO2 and produce a spent absorbing effluent containing the corresponding metal bisulfite. The spent effluent is treated to produce SO2 and regenerated sulfite By interjecting the prescrubbing step between the source of the waste gases and the chemical absorption zone in the SO2 recovery system, waste gases containing suspended solids in amounts up to as high as 10 grains/cu ft of gas or even higher are so effectively cleaned of the solids that the problem of solids contamination and build-up in the SO2 recovery system is essentially obviated. One advantage of the removal of SO3 from the waste gases entering the chemical absorption zone is a consequent lessening of the amount of potassium sulfate produced in the chemical absorption step and, therefore, a reduced need for costly separations of potassium sulfate crystals from potassium pyrosulfite crystals. Since the scrubbing water acts selectively to absorb SO3, substantially all of the dioxide remains in the gases for absorption by the potassium sulfite and, if desired, for subsequent recovery as high purity liquid SO2.

24602 **APTIC NO. 45693**

Public Nuisance Control Assoc., Tokyo (Japan)

STUDIES ON BASIC PLANS OF KP PLANT BAD ODOR CONTROL MEASURES - REPORT ON LITERATURE INVESTIGATION ON KP PLANT BAD ODOR CONTROL MEASURES. *(KP kojo akushu boshi taisaku no tame no kihon sekkei ni kansuru kenkyu). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 8(8):493-516, Aug. 1972.*

Sources of offensive odor and control methods for their removal at kraft pulping plants are reviewed. Odorous gases from sources such as vacuum evaporators and vents are collected and burned; condensed substances from the same sources are treated the same way after stripping. The deodorization of black liquor by oxidation is effective. Odors from the recovery boiler and lime kiln can be minimized by varying the operating conditions. Various methods have been developed for the treatment of odorous gases from the cascade and other evaporators, including air contact evaporation in which preheated air is supplied to the contact evaporator and to the recovery boiler as primary and secondary air for the combustion of odorous gases.

24603 **APTIC NO. 45699**

AM FIRST WITH 73 MODELS. *Machine Design, 19(44):28-29, Aug. 10, 1972.*

Besides other new characteristics (bumpers and lineup) the new American Motors (AM) 1973 automobiles have stricter emission standards. American Motors solved the problem with Exhaust Gas Recirculation (EGR). An EGR valve, bolted directly to the intake manifold, vents 10 to 12% of the exhaust gases back into the cylinders for additional burning. Nitrogen oxides are reduced by 50% by the process. A new electric-assist choke was added to combat carbon monoxide. When the choke-housing temperature reaches 80 F, the electric-assist quickly supplies heat to the bimetal spring in the choke housing, permitting the choke to open much faster, leading to a 50% reduction of carbon monoxide. All AM six-cylinder engines have induction-hardened valve seats to protect against wear when no-lead fuel is used. It is recommended to take on a tankful of leaded gas at every fourth fillup to prevent excessive valve-seat wear.

24604 **APTIC NO. 45717**

DUST COLLECTION IN THE ELECTRIC STEEL PLANT GEISWEID OF THE STEEL WORKS SUEDWESTFALEN AG. *(Entstaubung des Elektrostahlwerkes des Werkes Geisweid der Stahlwerke Suedwestfalen AG). Text in German. Stahl Eisen (Duesseldorf), 92(16):799-800, Aug. 1972. 1 ref.*

The steel plant Geisweid (West Germany) has two 30-ton and one 80-ton electric arc furnaces. Prior to installation of a dust collection system extensive studies were carried out. Based on these studies, it was decided to equip one 30-ton arc furnace and the 80-ton arc furnace with exhaust fans for directly drawing-off the waste gases. The second 30-ton arc furnace will be connected to a roof exhauster to save space. A cloth filter dust collection system is planned. It will have four ventilators, each with a capacity of 400,000 cu m/hr. The cloth filter house will be 28 m high and will cover a volume of about 35,000 mm. Installation of the system will begin in fall of 1973. It should be in operation by the beginning of 1974. The cost of the plant is estimated at about $3.5 billion.

24605 **APTIC NO. 45900**

California Univ., Livermore, Lawrence Radiation Lab.

HEPA FILTER TESTING DOP VS NA(CL). *In: Hazards Control. Progress Report No. 41. September through December. TID-4500, UC-41, p. 11-13, March 22, 1972. 1 ref.*

NTIS: 0UCLR-50007-71-3

A high efficiency particulate air (HEPA) filter, made from fibrous materials, has emerged as the device most often used to remove fine particulates from gaseous effluents. Dioctyl phthalate (DOP) and a La Mer generator gave the required test aerosol. The British believe that a small, polydispersed, solid aerosol is a more realistic test for penetration. They utilize sodium chloride as their test material. The test aerosol is composed of particles mainly within the range of 0.02 micron to 2.0 micron equivalent diameter and has a mass median diameter of about 0.7 micron. The two test methods were compared. A system was fabriacted for testing HEPA filters using a sodium chloride aerosol. The correlation between the two methods of filter testing, at rated flow of 1000 cu/ft min and at 20% of rated flow on filters which were normally out of spec. Results were compared to the Hanford and the manufacturers DOP test, again at rated flow and 20% of rated flow. The DOP is a more searching test than sodium chloride for the HEPA filter. (Author conclusions modified)

24606 **APTIC NO. 45923**

Hittman Associates, Columbia, Md.

STUDY OF THE FUTURE SUPPLY OF LOW SULFUR OIL FOR ELECTRICAL UTILITIES. *Office of Air Programs Contract EHSD 71-43, HIT-499, APTD-1078, 74p., Feb. 1972. 28 refs.*

NTIS: PB 209257

The utility industry's demand for residual oil will increase from 0.64 million barrels/day in 1970 to 2.24 million bbl/day by 1980. This growth rate stems from the scarcity of natural gas, the inability of many coals to meet emission standards, and a slowdown in nuclear power station construction. Despite slightly rising costs, oil has become the fuel of choice in many areas. Low sulfur residual oil will not meet demand without an intense effort beyond reasonable expectations. Desulfurization of domestic and foreign oil is necessary. Stack gas sulfur dioxide removal systems will be used in large base-loaded oil-burning plants in order to utilize the high sulfur residual oil which cannot be directly desulfurized economically. Domestic refineries should be encouraged to increase their yield of residual oil and to more effectively utilize domestic low sulfur crude feedstock.

24607 **APTIC NO. 46142**

Osaka Gas Co., Ltd. (Japan)

FEATURES OF DESULFURIZATION (FUMAKS PROCESS) AND CYANIDE REMOVAL (RHODACS PROCESS). *(Fumakkusu-shiki datsuryuho, rodakkusu-shiki datsushianho ni tsuite). Text in Japanese. Kagaku Kogyo (Tokyo), 23(7):922-927, July 1972.*

The Fumaks process of desulfurization uses piclin acid as a catalyst; the desulfurization rate is almost 100%. It has a low rate of by-product salt and a high rate of collection of sulfur. The catalytic action of piclin acid is fast and needs little air. The cost of chemicals for desulfurization is cheaper than other methods. A flow sheet of the Fumaks process with a description of its operations is presented. It consists of a tower to absorb hydrogen sulfide and a reproduction tower in which the absorbed water and the air are catalyzed and H2S in the liquid becomes solid from oxidation. In the Rhodacs process, hydrogen cyanide is removed as a solid thiocyanate salt. A flow sheet accompanies the description of its operations. The operation is easy, efficient, and economical. It makes possible the effective utilization of noxious components with each other such as hydrogen, hydrogen cyanide, and ammonia. Desulfurization and cyanide removal can be done at the same time. The rate of cyanide removal is almost 100%. Thiocyanate salt conversion of HCN is very fast and cyanide is not isolated in the circulating liquid. In this process hydrogen cyanide is removed as a solid. The important factors of desulfurization and cyanide removal, alkali levels, the concentration of catalyzers, and temperature are discussed.

24608 **APTIC NO. 46176**

GAS COOLING REDUCES CUPOLA BAGHOUSE SIZE. *Foundry, 100(9):102-104, Sept. 1972.*

The first application of equipment incorporating a new gas cooling technique for baghouses that process high temperature cupola gases now is operating at D. R. Sperry Co., North Aurora, Illinois. The project involved installation of an afterburner for hydrocarbon and carbon monoxide incineration; approximately 50 ft of stainless steel ducting; an atomized water spray system; a cyclone collector; a baghouse; and necessary controls. The Combustion Equipment Associations system minimizes the amount of air that must be added to the cupola gases prior to reaching the baghouse and thus reduces baghouse size by approximately 25%. Operation and design of the system are described.

24609 **APTIC NO. 46178**

THREE GIANT SCRUBBERS REMOVE IRON OXIDES FROM FLUID BED REACTOR GASES. CLEANED GASES CONVERTED TO SULFURIC ACID. *Ind. Heating, 21(7):1305-1306, 1308, July 1972.*

At Cities Service s newly expanded mining and ore treatment center in Copperhill, Tennessee, three giant scrubbers remove 215 lbs of iron oxide dust/min from 240,000 stand. cu ft/min of fluid bed reactor gases. The scrubbers are of the tray type and each incorporates a humidifier zone in the lower section where incoming gases are spray cooled from approximately 600 to 175 F. Spraying also removes larger size particulate matter. Tray sections above the humidifying zones comprise two horizontal perforated trays and scrubbing liquor flows across these trays. Tray perforations act as nozzles which form the gas stream into hundreds of small jets. The jets impinge on small plates positioned above the perforations and dust particles rebound into the liquor which carries off more than 99% of the particles. The three scrubbers which clean the gases are the largest sulfur dioxide scrubbers ever built and measure 80 ft high by 18 ft in diameter. They are made of corrosion resistant alloy 20 and type 316 ELC stainless steel. Upper and lower tray recycle circuits are described.

24610 **APTIC NO. 46179**

OXYGEN ANALYZERS SCREEN SMOKE FOR HIDDEN PROFIT. *Chem. Week, 111(9):37, Aug. 30, 1972.*

Some 2000 oxygen analyzers will be installed in chemical plants, steel mills, and power generating stations this year. An oxygen analyzer that maintains the proper fuel-to-air ratio can cut a company s fuel bill by 0.1% for each 0.2% reduction in excess oxygen consumed. On-line analyzers are grouped in two classes: those that measure the paramagnetic properties of oxygen and those that measure th oxygen content with an electrochemical cell. Features of these two types of analyzer are cited. Control of oxygen can reduce hydrocarbons in flue gases during combustion processes.

24611 **APTIC NO. 46197**

OIL SOLVES HOSPITAL S PROBLEMS. *Fuel Oil Oil Heat, 31(8):32-33, Aug. 1972.*

Gordon-Piatt model 1F10 forced draft burners utilizing Turbo-Ring stainless steel combustion heads were used to replace boilers firing coal at the St. Francis Hospital in Evanston, Illinois. Details of the new units are mentioned. With safe, clean, dependable oil there is zero smoke on high fire, and maintenance and fuel costs are also reduced.

24612 **APTIC NO. 46261**

BUILDS ADVANCED CANNERY IN PUERTO RICO. *Food Eng., 44(8):112-113, Aug. 1972.*

Although there is not much pollution in tuna processing, there are offensive fumes, which have been controlled by scrubbing the air with chlorinated water at Westgate California Corporation s new $10 million tuna cannery at Ponce, Puerto Rico. Processing water is strained, pumped over three hydrasieves, and released to the sea. Westgate s quality control measures include the installation of a $1500 mercury detection system on their tuna seiners.

24613 **APTIC NO. 46264**

DRY PROCESS FOR SO2 REMOVAL DUE TEST. *Oil Gas J., 70(34):67-70, Aug. 21, 1972.*

A new tail gas desulfurization process using a dry, regenerable absorbent based on copper oxide will shortly have its first tryout in a Japanese refinery. Its use in a power station is described. Advantages claimed for the dry acceptor material are: no loss of thermal buoyancy in the gas; no waste disposal problem; design simplicity in that heating and cooling between the acceptance and regeneration are about equal; required process energy is achieved by chemical reaction in that in effect sulfur dioxide is oxidized to sulfur trioxide, with a subsequent reduction to SO2. The process was developed by Shell in the Netherlands. The principal reaction of the process is described, in addition to regeneration reactions, pilot plant operation, and sulfur production. Capital and operating costs are given.

24614 **APTIC NO. 46367**

VENTI LARGE-SIZE DUST COLLECTORS. *(Venti-Grosstaubungsanlagen). Text in German. Zement-Kalk- Gips (Wiesbaden), 25(8):402, 1972.*

Venti dust collectors are designed according to VDI guideline 2260. They operate with a collection efficiency of 99 to 99.99% (for fine dusts of more than 0.2 micron diameter whose fraction is less than 5%). The collectors are composed of filter cells in an envelope shape. They provide a large collection surface. They are cleaned at certain intervals by a rapping device. Depending on the type of dust, the filters can be loaded with 100 to 150 cu m/hr/sq m. The material for the filters is selected according to the grain size of the dust and the specific properties of the dust. Two versions of the dust collector are illustrated, the envelope-type collector and the cylindrical collector with filter tubes. The collectors are mostly used in the chemical and rubber processing industry, in foundries, and everywhere large dust quantities are produced. They can also be used for dust cleaning atmospheric air.

24615 **APTIC NO. 45425**

Aigenson, Alexandr Sergeevich, Vladimir Vasilievich Fryazinov, Fatkulla Khairullovick, Julia Sergeevna Sabadash, Vladimir Stefanovich Akimov, Natalia Ivanovna Dobrozrakova, Genrikh Arturovich Berg, Boris Mikhailovich Ezhov, Georgy Alfonsovich Vorms, Rudolf Kubicka, and Yaroslav Veprek

METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS. *(Bashkir Scientific Research Inst. for Petroleum Refining, Ufa (USSR))*

Brit. Pat. 1,267,010. 12p., March 15, 1972. (Appl. July 15, 1970, 7 claims).

Existing methods for removing asphaltenes and heavy metals from high-sulfur petroleum residues require complicated equipment for carrying out catalytic thermal heat treatment or for evacuation of the precipitated solid asphaltenes. These disadvantages are overcome by first deasphalting petroleum residues with a C4-8 paraffin hydrocarbon solvent, then by catalytic destructive hydrogenation over a metal oxide catalyst at 350-450 C and 100-300 atm. The volume ratio of hydrogen to the deasphaltate is 200-2000:1. Thus, a residue of sulfur-bearing resinous petroleum was treated with a light petroleum fraction boiling at a temperature of less than 65 C and the deasphaltase subjected to catalytic destructive hydrogenation on a fixed-bed cobalt oxide-molybdenum oxide catalyst on active aluminum oxide, with a hydrogen-deasphaltate ratio of 1000:1. High-quality motor fuel and boiler plant fuel were obtained.

24616 **APTIC NO. 45454**

Aldridge, Clyde Lee and Robert Harry Waghorne

DESULFURIZATION OF FLUID PETROLEUM COKE. *(Esso Research and Engineering Co., Linden, N. J.) Brit. Pat. 1,268,457. 4p., March 29, 1972. (Appl. March 12, 1970, 10 claims).*

An improved process is presented for desulfurizing fluid petroleum coke with steam at elevated temperatures and pressures. The coke is partially gasified with steam at a temperature ranging from 800 to 2500 F and at pressures ranging from 200 to 3000 psig. Preferably, the reduction of sulfur in the unconverted coke is reduced to less than 1.5 wt%. The reaction may be conducted in the presence of an alkali metal carbonate catalyst. The partial gasification of the fluid petroleum coke is best accomplished using gas velocities of greater than 0.1 ft/sec in either a fixed or fluid bed. Previous processes involved both steam treatment and the addition of hydrogen whereby the sulfur content of the fluid coke was reduced only to about 4 wt%. Hydrogen and the multiple treatments were relatively expensive.

24617 **APTIC NO. 45398**

Ando, Yasuhiro

ELECTROSTATIC PRECIPITATOR. *(Denki shujinki). Text in Japanese. (Mitsubishi Heavy Industries, Ltd. (Japan)) Japan. Pat. Sho 47-32098. 3p., Aug. 17, 1972. (Appl. Feb. 19, 1969, 1 claim).*

This device relates to an improved electrostatic precipitator. The new electrostatic precipitator consists of a discharging electrode that is connected to a high voltage source and serves for charging the particles and for generating an electric field for collection, a solenoid that generates an electromagnetic field and serves as dust collector as well, and a cylindrical case with a flue gas inlet tube at the bottom and a pure gas outlet tube at the top. The solenoid is connected to an excitation electrode that supplies electricity for the electromagnetic field; with this arrangement, the operating voltage can be increased. By means of an automatic control system, electricity is supplied to the solenoid in amounts based on flue gas conditions.

24618 **APTIC NO. 45424**

Arai, Kashi

AIR CLEANING DEVICE. *(Kuki seijo sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 47-34546. 2p., Aug. 31, 1972. (Appl. July 25, 1970, 1 claim).*

This invention relates to a continuous air-cleaning apparatus. Single fibers or spun yarns are woven horizontally at high condensity, and at certain distances; spun yarns are woven vertically to the horizontal fibers or yarns at small width, which serves to hold the horizontal fibers or yarns at constant positions. The two ends of the woven yarns are jointed and fitted to two rollers to form an endless rolling filter. A shielding plate is placed in between the two woven layers, and a brush is equipped on the back layer of the filter. Air for cleaning is blown on the front layer of the filter, by which dusts are removed. The woven yarns are continuously rolled through the actions of the two rollers so that the dusts remaining on the filter are removed by the brush.

24619 **APTIC NO. 46366**

Belting, K. W.

PROCESSING OF PHOSPHOGYPSUM TO ANHYDRITE FOR THE GYPSUM/SULPHURIC ACID PROCESS. *(Aufbereitung von Phosphorgips zu Anhydrit fuer das Gipsschwefelsaeure-Verfahren). Text in German. Zement-Kalk-Gips (Wiesbaden), 25(8):387-390, 1972. 5 refs.*

On the basis of experiments and experience in connection with the start-up of a production plant, two methods are described which are suitable for the processing of filter-moist phosphogypsum to anhydrite. In one of these methods the entire process is performed in a turbine calcinator; in the other, drying is done in a flow dryer with the addition of dry return material. The splitting off of crystal water makes it possible to add sulfuric acid to the dry material and thus to reduce an excessive fluorine content of the phosphogypsum to an acceptable level during calcination. The waste gas is cleaned in an electrostatic precipitator. In the case of the calcinator the waste air is passed via a shaft to the precipitator. The cleaned air is blown into the atmosphere, and the dust returned to the process.

24620 **APTIC NO. 46199**

Beltran, Michael R.

SMOKE ABATEMENT FOR TEXTILE FINISHERS. *Am. Dyestuff Reptr., 61(8):42-44, Aug. 1972.*

When textiles coated with lubricating oils or plasticizer are heated in ovens, tenter frames, or dryers, a highly visible, bluish-white, odorous smoke is formed. Due to community concern with pollution control, textile dyers and finishers will be forced to eliminate smoking in the near future. Design considerations and selection of smoke abatement equipment are discussed. The merits, disadvantages, and economics of various equipment systems are considered. Particular consideration is given to the use of fume incineration and electrostatic precipitation to abate oil and plasticizer smokes. (Author abstract modified)

24621 **APTIC NO. 46169**

Bennett, Keith W.

ECOLOGY S LATEST SACRIFICE: BURNED NO. 2 BUNDLES? Iron Age, 210(9):28, Aug. 31, 1972.

Steelmakers can use unburned auto bodies--No. 2 bundles--as charge material for their open hearth furnaces, with their air pollution equipment handling the burnoff of non-metallics. In addition to giving the mills at least a mild leg up in meeting the original and operating costs for their air pollution material, the unburned No. 2 bundle brightens prospects for big baling presses.

24622 **APTIC NO. 45749**

Blosser, Russel O.

MISCELLANEOUS SOURCES AND TRENDS IN KRAFT EMISSION CONTROL: OVERVIEW. *TAPPI, 55(8):1189-1191, Aug. 1972. 2 refs. (Presented at the Technical Association of the Pulp and Paper Industry, Annual Meeting, New York, Feb. 14-16, 1972.)*

Sulfur emissions from miscellaneous kraft pulping processes and various control techniques within the industry are outlined. Operating conditions for the smelt tank, brown stock washer system, black liquor oxidation tower, lime mud washer, and lime slaker vents were identified to study their effects on emissions. As one means of emission control, the flue gas direct contact evaporator was eliminated from the unit process. Simultaneously, the potential emission control capability of black liquor oxidation was more extensively exploited. In conjunction with advanced control technology, improved measurement and analytical techniques were developed and higher emission standards were established by the federal government. Sulfur emissions from the various sources, including organic sulfur compounds and hydrogen sulfide, were determined with respect to operating variables. Miscellaneous source control techniques include incineration, particulate filtering and collection, and operation and process modifications; the control of operating variables for sulfur emission control is emphasized.

24623 **APTIC NO. 46348**

Botts, M. V. and R. D. Oldenkamp

THE MOLTEN CARBONATE PROCESS FOR SULFUR DIOXIDE REMOVAL FROM STACT GASES: PROCESS DESCRIPTION, ECONOMIS, PILOT PLANT DESIGN. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 15p., 1972. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-20, 1972, Paper 72-115.)*

The molten carbonate process for removal of sulfur oxides from power plant stack gases has been under development since 1966. The preliminary development work has now been completed, and a pilot plant test program is underway. In the molten carbonate process, a molten eutectic mixture of lithium, sodium, and potassium carbonates is used to scrub the power plant gas stream. The sulfur oxides in the gas stream react with the carbonates to form sulfites and sulfates, which remain dissolved in an excess unreacted carbonate melt. The spent molten carbonate-sulfite- sulfate mixture is then regenerated chemically, converting the sulfite and sulfate back to carbonate and recovering the sulfur as hydrogen sulfide. The regenerated carbonate is then recirculated to the scrubber to repeat the process cycle. The pilot plant consists of a scrubber system, a 10-foot diameter spray chamber 25-feet high expected to remove 95% or more of the sulfur oxides and all the ash from the gases; two parallel ash filters, collecting up to 9 lb/hr of oil ash for 0.05 grains/sec/cu ft of ash; a reduction system, which has a 10-foot diameter, an alumina-lined vessel, 16-feet high, divided by a baffle into two compartments (oxidation and reduction compartments, respectively), from which the melt leaves at 1500 F to be cooled to 950 F a quench tank. The quench tank heat exchanger is an air-cooled 750,000 Btu/hr unit, utilizing recirculated hot air. From the quench tank the melt flows into one of two parallel coke filters; passes to the regeneration system which is a sieve-tray tower 18 inches in diameter by 40 feet high containing 15 trays. The pilot plant is provided with a Claus plant to recover in elemental form the sulfur removed from the power plant stack gases, the reheat furnace combustion gases, and the coke used in the reducer. The flue gas stream is exhausted to the atmosphere through a stub stack on the scrubber. Results of economic analyses indicated that the estimated annual operating cost for the 800-MW coal- burning plant amounts to $5,000,000 or about 1,000,000/kwh, a competitive cost when compared with other stack gas treatment processes. (Author conclusions modified)

24624 **APTIC NO. 46153**

Brown, G. N., S. L. Torrence, A. J. Repik, J. L. Stryker, and F. J. Ball

SO2 RECOVERY VIA ACTIVATED CARBON *Chem. Eng. Progr., 68(8):55-56, Aug. 1972. 1 ref.*

A dry, low temperature sulfur dioxide recovery process was developed which uses sequential fluidized beds of continuously recycled activated carbon to remove SO2 from boiler flue gases and directly produce elemental sulfur. Development of the process is described, with particular emphasis on the kinetics of SO2 sorption from boiler flue gases to permit the subsequent design of reactors to affect this removal.

24625 **APTIC NO. 46182**

Callahan, Joseph M.

GM S HOTTEST AUTOMOTIVE EMISSION ELIMINATOR. *Automotive Ind., 147(4):25-28, Aug. 15, 1972.*

General Motors is in the final development stage of a significant breakthrough that will definitely go a long way toward meeting the Government s stringent 1975 emission standards. Officially called EFE for early fuel evaporation, this development is also called the hot spot, the quick-heat manifold, and fast choke. Essentially EFE is a super sophisticated version of the old idea of applying heat to the engine s intake manifold. In this case, exhaust heat is used to evaporate the liquid gasoline that always passes through the carburetor at start-up. By evaporating the large amount of liquid fuel that normally sloshes around on the floor of the intake manifold at start-up, the emission engineers essentially are making the gasoline engine operate like a liquid propane gas or a natural gas engine. The EFE helps get the engine operating quickly on a lean fuel-air mixture, allowing the choke to come off much earlier than usual. Design features and problems and challenges of this system are discussed.

24626 **APTIC NO. 45396**

Chiba, Yoshiichi

HYDROCHLORIC ACID RECOVERY METHOD FROM THE EMISSION GAS OF PLASTIC WASTE HEAT TREATMENT. *(Purasuchikku haikibutsu no netsushori hassei gasu yori ensan o kaishu seisei suru sochi). Text in Japanese. (Takuma Co., Ltd. (Japan)) Japan. Pat. Sho 47-32509. 3p., Aug. 18, 1972. (Appl. May 26, 1970, 1 claim).*

This device relates to apparatus for the treatment of hydrogen chloride gas from the combustion of plastic wastes and its recovery as commercial hydrochloric acid. The plastic wastes are first treated at 260 C to 300 C until the generation of HCl is completed, after which the gas is led through a heat exchanger to an absorption tower where all the HCl is absorbed by water. Plastic waste residues are completely burned in a combustion chamber, and the exhaust gas discharged from the stack after passing through a heat exchanger and a dust collector. The concentration of the recovered hydrochloric acid is automatically adjusted.

24627 **APTIC NO. 45668**

Crecelius, H. J. and W. Forwerg

SEPARATION OF NICOTINE AEROSOLS FOR THE DETERMINATION OF NICOTINE IN INDOOR AIR. *(Abscheidung von Nikotin-Aerosolen zur Bestimmung von Nikotin in Raumluft). Text in German. Zbl. Arbeitsmed., 22(7):200-203, July 1972. 3 refs.*

To obtain a gas mixture with nicotine aerosols, cigarettes were smoked in a 15-liter round-bottom flask. The acheived smoke density corresponded to that in a fully occupied train compartment for smokers. The nicotine-containing gas mixture was passed with a vacuum pump to two sets of two series-connected glass-fritted gas scrubbers at a speed of 60 l/hr. Each scrubber contained 30 ml absorption solution of 0.1N sulfuric acid and 0.2% n-butanol. The second branch of the gas flow passed an additional separator after passage through the two scrubbers. For controlling the efficiency of the separators, the gas mixture could be passed over a bypass where two scrubbers were arranged behind two separators. Membrane filters and electrostatic precipitators were used as separators. The average relative collection efficiency for membrane filters and the separator with scrubbers was about 96-97%. The results with the electrostatic precipitator were unsatisfactory.

24628 **APTIC NO. 45365**

Cross, Frank L., Earl B. Fox, Richard G. Mumford, and Michael E. Fiore

UPDATING INCINERATORS TO MEET CURRENT CRITERIA. *Waste Age, 3(1):28-35, Jan./Feb. 1972.*

Medium-energy wet scrubbers were selected as the best device to control emissions from incinerator stacks in apartment houses operated by the Philadelphia Housing Authority. The decision to install the scrubbers was based on a study which showed that the expense of initial installation and maintenance of fabric filters and electrostatic precipitators is unjustified in apartment housing installations. The estimated and contracted costs of modifying three incinerators are listed and cross-sectional drawings of the modified incinerators are shown. The upgrading of the facilities will require the training of operating personnel, as the new incinerator configurations and scrubbers will not perform as designed without careful maintenance and operation.

24629 **APTIC NO. 46035**

Cross, F. L., Jr. and Glenn E. Benson

IS INCINERATION THE ONLY ALTERNATIVE FOR CONTROLLING AIR POLLUTION EMISSIONS FROM THE MANUFACTURE OF STEEL SHIPPING CONTAINERS? Preprint, American Inst. of Chemical Engineers, New York, 30p., 1972. 5 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 72nd, St. Louis, Mo., May 21-24, 1972.)

Different alternative methods of controlling atmospheric emissions are discussed. The steel shipping container industry has expanded and standardized its product. This industry is currently confronted with air pollution codes relating to odors, particulates, and hydrocarbon emissions from the manufacturing operations. The manufacturing process is described. The Environmental Protection Agency has recently promulgated a national ambient air quality standard for hydrocarbons. The standard -- 160 micrograms/cu m is a maximum 3-hour concentration not to be exceeded more than once a year. Many states have not stipulated allowable hydrocarbon or solvent emissions from paint-drying ovens or paint-spray operations. Thermal incineration, catalytic incineration adsorption, and process modifications are methods by which solvent emissions from paint-spray operations and paint bake ovens may be controlled. Thermal incineration should be used to control the atmospheric emissions from a steel shipping container plant. A typical design would include provisions for ducting the emissions from the ovens to one fume incinerator and the emissions from the spray booths to a separate incinerator. Economic considerations dictate that the proposed system operate with a heat-recovery unit with a minimum of 65% heat recovery. With a rotary regenerative heat exchanger, 75 to 80% heat recovery may be possible. The incinerator of the proposed fume incinerator would handle approximately 20,000 standard cu ft/m of process gases. The afterburner should be the modulating type. The capability of adjusting heat input has to be of optimum condition. Low-sulfur oil may be necessary if there is a scarcity of natural gas. The air for atomization of fuel oil must be drawn off the process air stream before the process air passes through the heat exchanger. Burner arrangement must be of such a design that the preheated effluent gases pass through the flame upon entering the incinerator. (Author conclusions modified)

24630 **APTIC NO. 46120**

Dickson-Simpson, John

MAKING DIESELS SOCIABLE. *Transport Eng. (London), 1972:10-12, April 1972.*

Some operation and design modifications to control diesel engine contributions to air pollution as adapted by 2 commercial companies are reviewed. Over 40% of the research budget of firm is devoted to abating exhaust smoke, gaseous emissions, and noise of diesel engines. Turbochargers are indicated for exhaust pollutant reduction in all engines designed to meet 1975 California limits of 25 g/hp/hr of carbon dioxide emissions and 5 g/hp/hr of nitrogen oxides plus hydrocarbon emissions. Engine noise is decreased by soundproofing side covers and turbocharging, but, because the manner of installation is important, the sale of complete power packs rather than engines alone is considered.

24631 **APTIC NO. 45410**

Egusa, Shigeo

HEAT MANAGEMENT AND POLLUTION CONTROL IN PAPER FACTORIES. *(Seishi kojo no netsu kanri to kogai taisaku). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(9):30-34, Sept. 1972.*

The heat management and pollution control at a paper factory producing 1000 tons of products per day are described. Steam required is 13,000 tons/day, among which, 50% is generated by heat recovered from black liquor. There are eight boilers with capacities ranging from 26 t/hr to 120 t/hr. Hot water from heat exchangers of evaporators and scrubbers is utilized to produce steam for pulp bleaching. Scrubbers are equipped at three boilers burning heavy oil, and a combination of electrostatic precipitators and scrubbers is applied for dust collection. The desulfurization efficiency is more than 90% and total dust collection efficiency is more than 98%. Odors are controlled by complete oxidation of sulfur compounds in the black liquor, combustion, and washing of the resulting odorous gases.

24632 **APTIC NO. 45444**

Emi, Hitoshi

AIR CLEANING DEVICE. *(Kuki seijo sochi). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 36(8):826-831, Aug. 1972. 27 refs.*

The dust collection properties of an air cleaner are reviewed. Emissions usually contain low concentrations of particles less than 5 micron in diameter. Air filters or electrostatic precipitators are used for this particular purpose. Materials for filter construction include glass fibers, asbestos, natural fibers such as cellulose, synthetic fibers such as polyester and polyurethane, and metals. The efficiency of a filter depends largely on the electrostatic property of the filter material and the sticking force between the filter material and the particles. Methods for measuring the dust collection efficiency of air filters include gravimetry, colorimetry, and particle counters. Dust collection efficiency also depends on the initial velocity of the air stream.

24633 **APTIC NO. 46114**

Emi, Hitoshi, Kiyoshi Nakata, and Naoya Yoshioka

COLLECTION EFFICIENCIES OF AEROSOLS BY FIBROUS PACKED BED UNDER THE INFLUENCE OF GRAVITY. *(Juryoku no eikyo o koryo shita baai no seni jutenso ni yoru earozoru no roka koritsu). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 36(5):557-563, May 1972. 9 refs.*

Collection efficiencies of aerosols by a fibrous packed bed under the influence of gravity was studied with mathematical equations. A diagram of limiting particle trajectory and figures showing the theoretical settling-inertia-interception collection efficiency of an isolated cylinder are shown. An experiment was conducted with polydispersed stylene divinyl benzene copolymer latex particles and monodispersed polyvinyl toluene latex particles. A glass fiber mat coated by adhesive material was used. An example of the frequency distributions of aerosol particle size at filter inlet and outlet is shown with a figure. The theoretical value and the experimental data are compared concerning overall filter efficiency. Also, figures of comparison of experimental single fiber collection efficiencies with theoretical ones in the settling and inertia predominant region are shown. Single fiber collection efficiencies due to settling, interception, diffusion, and values of particle diameter dp at a given difficiency ratio are presented. Calculated efficiency curves and corresponding experimental data in the low velocity region and a comparison of experimental with calculated efficiencies are presented. Uni fiber theoretical efficiency can estimate collection efficiencies under the influence of inertia, diffusion, and gravity.

24634 **APTIC NO. 45672**

Etsuzenya, Sadayoshi and Rinjiro Kawai

ELECTROSTATIC PRECIPITATOR. *(Denki shujin-ho). Text in Japanese. (Japan Plant Construction Co., Ltd.) Japan. Pat. Sho 47-26822. 2p., July 19, 1972. (Appl. April 12, 1967, 2 claims).*

This invention relates to improvements in the dust collection efficiency of an electrostatic precipitator. Dusts of low electric resistance are blown into the stack to mix with dust of high electric resistance, thus increasing the collection efficiency. The efficiency is further increased by spraying water on the dust mixture to increase the moisture content. The collection efficiency is increased from 60% to approximately 90% by the addition of 5 to 10% of dusts with electric resistance of 5 times 10 to the plus 10th power ohm/cm to dusts with electric resistance of 10 to the plus 13th power ohm/cm and 10% moisture content or to dusts of 10 to the plus 12th power ohm/cm resistance and 20% moisture content. The efficiency is further increased to more than 95% by increasing the moisture content of the dust mixture.

24635 **APTIC NO. 45904**

Fesenko, A. V. and G. P. Korneychuk

APPLICATION OF THE MICROCATALYTIC IMPULSE AND ISOTOPE METHODS TO THE STUDY OF THE CARBON MONOXIDE CATALYTIC OXIDATION MECHANISM ON CUPRIC OXIDE. *(Primeneniye impul snogo mikrokataliticheskogo i izotopnogo metodov dlya vyyasneniya mekhanizma kataliticheskogo okisleniya okisi ugleroda na okisi medi). Text in Russian. Dokl. Akad. Nauk SSSR, 202(6):1374-1376, June 1972. 9 refs.*

The catalytic oxidation mechanism of carbon monoxide on cupric oxide with increased oxygen-18 isotope content was studied by means of impulses microcatalytic and isotope methods with regard to the participation of contact-surface oxygen in the catalytic process. The experiments were carried out with 5.53 cu cm-shots of CO-helium mixtures containing 3% of CO on 0.5 g of CuO at a temperature of 350 C. The gas impulse having passed the catalyst was analyzed by chromatographic and mass-spectrometric methods. Complete conversion into Carbon dioxide of the CO content in the impulse was observed. The 018 isotope content of the fourth monolayer of the catalyst was estimated to be 65% higher than that in the surface-layer. The isotope exchange occurring in reactions of CuO with oxygen or CO2 was negligible with 0.029%. The oxygen present on the contact surface participated in the catalytic oxidation of CO on CuO catalyst. The isotope composition of CO2 showed variations as a function of the impulse frequency. The abrupt decrease in the 018 isotope concentration in CO demonstrates that the catalytic reaction occurs predominantly on the catalyst surface, without 018 isotopes located deep in the crystal lattice being involved.

24636 **APTIC NO. 45662**

Firnhaber, R. B.

EXHAUST GAS CLEANING BY ENGINE MODIFICATION. LESS POLLUTANTS BY EXHAUST GAS RETURN, CARBURETOR AND EXHAUST MODIFICATIONS. *(Abgasreinigung durch motorische Aenderungen. Weniger Schadstoffe durch Abgasrueckfuehrung, Vergaser- und Auspuffmodifikation). Text in German. VDI (Ver. Deut. Ingr.) Nachr. (Berlin), 26(32):11, Aug. 1972.*

Investigations into the effects of exhaust gas recirculation and carburetor and engine modifications on exhaust emissions from a Fiat 125 model powered with a lean mixture are described. Exhaust gas recirculated at a rate corresponding to 10-15% of the fresh air supply resulted in a minimum decrease of 50% in nitric oxide emissions due to decreased flame peak temperature. Carbon monoxide emissions dropped to 0.5%, but hydrocarbon emissions reached several thousand ppm. To reduce the hydrocarbon emissions, a throttle control that delayed full closure until after engine speed fell to a certain value was provided. The resulting decrease in engine output was eliminated by improved fuel distribution and increased air supply through enlarged air nozzles. to improve combustion at idle and deceleration, ignition at closed throttle was delayed by about 12 deg and improved exhaust manifold insulation was applied. Exhaust recirculation and the above engine and carburetor modifications reduced engine output, particularly under part loads and low engine speeds, while the increase in the fuel consumption was less than 5%. The CO and hydrocarbon concentrations measured at idle were 0.1-0.3% and 40-60 ppm/test, respectively. To meet U.S. standards for 1975/1976 model cars, the use of lean mixture and exhaust recycling will, however, have to be combined with thermal or catalytic afterburning.

24637 **APTIC NO. 45705**

Fuechsel, Roman

POSSIBILITIES FOR ELIMINATING THE POLLUTANTS IN WATER CAUSED BY SULFITE CELLULOSIS PLANTS. *(Moeglichkeiten zur Behebung der Abwasserbelastung durch Sulfitzellstoffanlagen). Text in German. Umweltschutz Staedtereinig. (Vienna), 9(7):150-153, 1972.*

Control of water pollution from sulfite pulp manufacturing based on the magnesium bisulfite process is discussed together with related techniques and equipment. The magnesium sulfate present in the black liquor from the magnesium bisulfite process is decomposed to magnesium oxide and sulfur dioxide by means of the Babcock, Lenzinger, or Copeland processes, the latter using a fluidized-bed reactor for incineration. Copeland reactors are suitable for the incineration of liquor residues with a minimum calorific value of 1000 kcal/kg, as well as for burning additional sulfur. The SO2 present in the cold waste gases can form sulfur trioxide in the presence of water at oxygen excesses as low as 2.5-3%; the free oxygen content in the waste gas leaving the reactor must not exceed 2%, a requirement that is met by Lenzinger and especially by Copeland reactors. Both SO2 and MgO are removed from the waste gas in absorbers, the maximum allowable SO2 concentration in the discharge being 0.03% by volume. Absorbing towers with Raschig rings, applying counter-current at low flow rates, and three-stage venturi scrubbers are most suitable for such purposes. Copeland absorbers are filled with glass balls of 12-15 mm diameter to intensify absorption. Special three-stage Lenzinger absorbers, where the absorbing liquid is atomized by the waste gas flow and the liquid droplets are separated by a subsequent droplet separator, discharge waste gases with a maximum SO2 content of 0.01-0.02%.

24638 **APTIC NO. 45626**

Fujii, Fumio, and Yasuo Ichikara

ELIMINATION METHOD FOR LIGHT-WEIGHT DUST RESIDUE ON FILTER. *(Rokatai ni fuchaku shita keihiju no dasuto o torinozuku hoho). Text in Japanese. (Japan Electric Equipment Co.) Japan. Pat. Sho 47-3457). 3p., Aug. 31, 1972. (Appl. July 29, 1970, 1 claim).*

A method for removing light dust residues from filters is described. Petroleum oils of low viscosities are sprayed on the dust residues sticking to a filter. The dusts, which are generally less polar, disperse easily into the oils and drop quickly from the filter. Oils with viscosity of 35-106 centistokes at 38 C and surface tension of 15-25 dyne/cm are ideal for this purpose. An example shows that 80% of unburned carbon sticking on a 100-mesh metal net at 2 mg/sq cm is removed when oil with a viscosity of 40 centistokes at 38 C and surface tension of 15 dyne/cm is sprayed at a rate of 5 g/min for 2 min.

24639 **APTIC NO. 45728**

Fujii, Shoichi

CONTROL OF AIR POLLUTION INDOORS. *(Shitsunai no kuki osen no seigyo). Text in Japanese. Kuki Chowa Eisei Kogaku (J. Japan Soc. Heating, Air-Conditioning, Sanitary Engrs.), 46(6):530-538, June 1972.*

With recent enforcement of the law concerning securing of sanitary environment in buildings and other similar regulations, degrees of indoor air pollution are now subject to regulatory controls. Besides sanitary reasons, control of indoor air pollution is necessary in clean rooms to ensure product quality. The allowable limit values of various air pollutants for an indoor working environment are tabulated. For example, it is 100 ppm for carbon monoxide, 50 ppm for ammonia, and 1 ppm for chlorine. It is 2 mg/cu m for first-class suspended dust (powder dust containing 30% or more liberated silicic acid), 5 mg/cu m for second-class dust (powder dust containing less than 30% liberated silicic acid), and 10 mg/cu m for third-class dust (other kinds of dust than those above.) The construction standard law says the concentration of oxygen should not decrease by more than 0.5% from the normal value of 21%. Emission sources indoors of air pollutants such as smoking, carbon dioxide vapors emitted from human bodies, CO emitted from combustion devices, and consumption of oxygen by combustion devices are discussed. Various types of air cleaners including cyclones, baffles, air washers, bag filters, and electrostatic precipitators for dust removal; air washers, activated carbon filters, and chemical purification for gas purification; and high-performance filters, irradiation of ultraviolet rays, and sterilization by chemicals for germs, are briefly introduced. Finally, calculation formulas used to determine capacity and other performance factors of air cleaners for indoor use are explained.

24640 **APTIC NO. 45627**

Fujiwara, Ginjiro and Shoji Muranushi

VENTURI SCURBBER FOR HIGH TEMPERATURE CORROSIVE GAS. *(Koon fushokusei gasu yo benchuri sukurabba). Text in Japanese. (Hinode Chemical Industry Co., Ltd. (Japan)) Japan. Pat. Sho 47-34548. 2p., Aug. 31, 1972. (Appl. Feb. 25, 1970, 1 claim).*

This invention relates to a venturi scrubber for purification of high-temperature corrosive gas. Heat-resisting, corrosion-proof graphite or carbon moldings are used for the throat part where corrosion easily occurs due to the water from the nozzle and the dusts in gas. For the first part of the diffuser, where complete mixing of gas and moisture has not occurred and the inside wall is dried, a relatively corrosion-resistant metal is used; for the second part, where the wall is wetted and no temperature increase occurs, wood or synthetic resin is used.

24641 **APTIC NO. 45694**

Fukumoto, Tsutomu, Shu Mukai, and Yoshiro Hiraiwa

TREATMENT OF COMBUSTION GAS FROM POLYVINYL CHLORIDE AND TIRES. *(Pori enka biniru oyobi taiya no shokyaku ni tomonau haigasu shori). Text in Japanese. Preprint, Japan Society of Chemical Engineering, Tokyo, p. 10-12, 1972. 1 ref. (Presented at the Japan Society of Chemical Engineering, Annual Meeting, 37th, Nagoya, Japan, 1972.)*

Flue gases from the combustion of polyvinyl chloride and tires were treated in an absorption tower with 4 porous plate layers. Water and 1.5-2% sodium hydroxide solution were used as the absorbents for hydrochloric acid and sulfur dioxide, respectively. At a foam height of 40 mm, the efficiency of one plate for HCl removal was 63-80%; and at 0 foam height of 80 mm, the efficiency was 70-88%. Therefore, if the efficiency is 80% for one plate, the total efficiency is as high as 99.84% since it was verified that the four plates had almost the same efficiency. Comparison of the result to that obtained from air containing HCl at constant temperature showed that almost no mist and condensatin of HCl occurred when the high-temperature flue gases were cooled. The efficiency for sulfur dioxide absorption at a foam height of 80 mm was 60-80%, slightly lower than that for HCL.

24642 **APTIC NO. 46076**

Graham, Ward A.

ALKYLATION INTEGRATES ACID PLANT. *Hydrocarbon Process., 51(8):87-90, Aug. 1972. 15 refs.*

The design, operation, and costs of a combination sulfuric acid alkylation unit with its own acid plant are reviewed. The integrated operation upgrades hydrogen sulfide as a by-product to a valuable chemical commodity, sulfuric acid, while meeting all air pollution control requirements; maximizes alkylate quality by optimizing alkylation acid spending strength with acid plant feed rates; eliminates bulk acid transportation; and minimizes alkylation acid cost and labor cost. Applications and advantages of the system to the refining industry are discussed.

24643 **APTIC NO. 45408**

Hayashi, Miyoko

EMISSION GAS FROM SOFT POLYVINYL CHLORIDE RESIN MANUFACTURING PLANT AND ITS TREATMENT. *(Nanshitsu enka biniru jushi kako kojo no haigasu to sono taisaku). Text in Japanese. Akushu no Kenkyu (Odor Research J. Japan), 2(7):28-34, Aug. 1972. 15 refs.*

Irritant gases emitted from soft polyvinyl chloride resin manufacturing plants were measured and compared, and the control methods are described. The gases consist of plasticizer vapor, low molecular weight polyvinyl chloride, hydrogen chloride, phthalic acid, phthalic anhydride, ethylhexyl alcohol, hydrogen cyanide, formic acid, and formaldehyde. Measurement results from three plants showed that the plasticizers dioctyl phthalate and dibutyl phthalate were the major components in the flue gas. More than 80% of the plasticizer fumes were removed by washing methods, jet collectors, jet scrubbers, and two stage venturi scrubbers. Ninety-eight percent efficiency was obtained with the last method. For the first plant which had the highest plasticizer fume concentration in flue gas, an electrostatic precipitator was used to supplement the jet collector.

24644 **APTIC NO. 46092**

Hirakawa, Kimio

REDUCING SULFUR CONTENT IN FUEL AND FLUE-GAS DESULFURIZATION. *Chem. Economy Eng. Rev., 4(5):17-24, May 1972.*

Fuel-oil desulfurization techniques and the control of sulfur emissions from stack gases are discussed. The domestic fuel-oil desulfurization rate is expected to increase to 43,400,000 kl in 1973 for an estimated 24% of the total supply of fuels. The total daily capacity of fuel-oil desulfurization units at the end of 1971 was 356,500 barrels, with an estimated increase to 887,500 barrels. Residual oil desulfurization techniques include asphalt cracking and gasification. The major flue-gas desulfurization techniques include lime blowing, alkali absorption, lime-gypsum (wet process), caustic soda-sodium sulfite process, ammonium sulfate process, activated carbon process, water washing process, gas separation, steam separation, activated manganese oxide process, potassium sulfite (sodium sulfite) process, magnesium oxide process, alkalized alumina process, Shell-Japan Shell technology process (dry process). sulfuric acid absorption, and catalytic oxidation. The economics of flue-gas and fuel-oil desulfurization are considered.

24645 **APTIC NO. 45690**

Hishida, Kazuo

PROBLEMS OF PLASTIC WASTE COMBUSTION AND THEIR CONTROL. *(Purasuchikku ganyu haikibutsu no nensho shori ni yoru mondaiten to taisaku). Text in Japanese. PPM (Japan) 3(9):16-31, Sept. 1972.*

The combustion of wastes containing plastic refuse is discussed. Large amounts of hydrochloric gas are generated by the combustion of polyvinyl chloride; cyanides by the combustion of acrylic resin; ammonia by the combustion of urethane; and chlorine and other harmful gases by the combustion of neoprene rubber. Soots are also generated by incomplete combustion of plastics. The heat and corrosive gases thus generated very often cause damage to the apparatus. The concentrations of NH3, cyanides, nitrogen oxides, and aldehydes depend largely on the combustion temperature. It has been demonstrated that the concentrations of NH3, aldehydes, and cyanides are greatly reduced by increasing the combustion temperature. Criteria for the selection of suitable combustion apparatus are also described.

24646 **APTIC NO. 46170**

Iammartino, Nicholas R.

TECHNOLOGY GEARS UP TO CONTROL FINE PARTICLES. *Chem. Eng., 79(18):50-52, Aug. 21, 1972. 7 refs.*

Increasing concern over the atmospheric and health effects of fine particles is already demanding more powerful sampling and analytical instruments. The collection efficiency of currently used equipment--wet scrubbers, electrostatic precipitators, and fabric filters--falls off rapidly as particle size falls below a few tenths of a micron. Novel particle removal technology and some new twists in older control techniques are described. Scrubbing trends, use of waste heat, sonic agglomeration, elimination of reentrainment with electrostatic precipitators, charged droplets, space-charge precipitators, and filtration developments are discussed.

24647 **APTIC NO. 45770**

Irving, M.

FLOATING TANK-COVERS OFFER 90% CUT IN EVAPORATION LOSSES. *Can. Petrol., 13(7):29-31, July 1972.*

At the Irving refinery at Saint John, New Brunswick, and as part of a major expansion program, a 94-foot diameter tank was equipped with an internal, floating, and all-aluminum cover. There are hundreds of fixed-roof storage tanks at Canadian refineries that require a cover for reasons of pollution control. Covers floating on aluminum pontoons on top of the petroleum product control air pollution and reduce evaporation losses by at least 90%. Losses of petroleum products during storage and handling between the wellhead and the consumer amount to almost 3% of all crude oil production. Therefore the internal floating covers were developed. They are made of aluminum because installation costs for a typical 90-foot diameter tank range from $22,000 to $23,000, or 1/3 cheaper than installing the steel pan. The covers use a soft seal, positioned above the level of the product. Panels are 1 1/2-inches thick and clad with aluminum foil. Insufficient seal width and excessive irregularities of the tank wall cause cover hanging-up or jamming within the tank. The neoprene seal used at present can handle up to 75% aromatics. A new seal design is expected to withstand 100% aromatic materials. Soundly-designed covers satisfy the growing need to economically control emissions from fixed-roof tanks. Five years of experience indicate that there have been no sinking problems; no gas retention problems; no seal failure; only one instance of jamming; and no cases of material failure. All these problems occurred when employing rigid-plastic foam panels, clad on both sides with aluminum foil, and with a seal immersed in the product.

24648 **APTIC NO. 46148**

Ishibashi, Goya

PRACTICAL EXAMPLE FOR DESULFURIZATION OF FLUE GAS BY SODIUM HYDROGEN SULFITE METHOD. *(Aryusan soda-ho ni yoru haien datsuryu no jisshi rei). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(6):10-13, June 1972.*

Desulfurization apparatus using the sodium bisulfite method for flue gases from two crude oil burning boilers was described. The capacities of the boilers were 80 t/h and 180 t/h, providing turbine outputs of 10,000 kW and 23,700 kW, respectively. The sulfur content of the heavy oil was 2.5%; the gas treatment capacity of the apparatus was 270,000 n cu m/h. The apparatus consisted of an absorbing tower, liquid purifing equipment which converted all the sodium bisulfite to sodium sulfite and purified the solution, and smoke preventing equipment which purified white smoke from the absorbing tower. More than 90% of the SO2 was absorbed in the absorbing tower. The crude liquid product contained 20.8% Na2 SO3, 1.44% Na2SO4, 0.13% sodium carbonate, and trace amounts of sodium hydroxide.

24649 **APTIC NO. 45397**

Iwao, Norito, Tadashi Kawaguchi, Noboru Esaki, and Shigemi Hayashi

OXYGEN BLAST FURNACE EMISSION GAS CONTROL METHOD. *(Sanso josui tenro ni okeru haigasu shori seigyo hoho). Text in Japanese. (New Japan Ironworks) Japan. Pat. Sho 47-32483. 11p., Aug. 19, 1972. (Appl. Sept. 22, 1970, 1 claim).*

The control of air mixing to flue gas from an oxygen blast furnace is discussed. A pressure control system includes a pressure gauge and a damper. The heating is first carried at a defined furnace inside pressure until the maximum flue gas emission is reached and the corresponding position of the furnace exit and the metal skirt is fixed. The furnace inside pressure and/or this corresponding position are then corrected to certain values, obtained from previous heating, at which a certain amount of flue gas including air is emitted. The heating is continued to a point at which the desired carbon content of the steel is reached, by comparing the rate of decarbonation to that of the previous heating. Examples show that the carbon content is consistent with the expected values, and carbon monoxides are effectively recovered.

24650 **APTIC NO. 45671**

Jakubith, M. and P. Hugo

MECHANISM OF THE CARBON MONOXIDE CHEMISORPTION ON PLATINUM CATALYST APPLIED TO ALPHA-ALUMINA SUPPORT. *(Mechanismus der CO-Chemisorption am Platin-alpha-A12O3-Traegerkatalysator). Text in German. Z. Physik. Chem. Neue Folge (Frankfurt), 79(1/2):107-111, July 1972. 13 refs.*

The mechanism of the formation of the platinum-carbon monoxide system was studied on an alpha-alumina support impregnated with 0.8% platinum. Spectroscopic examinations revealed linear and bridge structures of chemisorbed CO on the platinum surface. The desorbable portion of CO pertained to the linear structure and the nondesorbable portion to the bridge structure. Reversible equilibrium between the free atoms of the platinum surface, the CO in gas phase, and the linear structure was established rapidly; one part of the linear structure then formed the bridge structure. The CO chemisorption enthalpy decreased with increasing degree of surface coverage, and reached an upper threshold value of -48 kcal/mol at very small degree of coverage. The two-stage chemisorption of CO on the platinum surface was dependent on the degree of coverage and CO pressure, respectively.

24651 APTIC NO. 46115

Kamitani, Koji, Akira Oba, and Yoshinobu Gunji

STUDIES ON DESULFURIZATION OF COKE MIXTURE PELLETS. *(Kokusu kongo peretto no datsuryu ni kansuru kenkyu). Text in Japanese. Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku, (Rep. Nat. Res. Inst. Metals), 15(2):31-38, 1972. 16 refs.*

The condition in which sulfur does not remain in pellets during reduction combustion was determined. The effect of lime addition and pore ratio on desulfurization, effect of by-product of reduction on desulfurization, and components of the combustion gas were studied. The experiment was conducted with iron ore and a 1200 C combustion temperature. The relationship between combustion time and sulfur remaining at 900 C is presented on a graph. The relationship between combustion time and sulfur remaining under the condition that the coke mixture pellets are covered with calcium oxide and calcium hydroxide is presented on a graph. The result of x-ray analysis of coke mixture pellets covered with $Ca(OH)2$ is presented. The relationship between pore ratio and desulfurization was discussed, and the distribution of pores are presented on graphs. Sulfur compounds of combustion gas were analyzed by gas chromatography. Lime addition is not effective to desulfurize coke mixture pellets. Pore ratio should be more than 40% and the distribution of pores should be uniform for effective desulfurization. Desulfurization should be done while iron oxide exists and before iron is produced during combustion. Sulfur in coke mixture pellets can be removed as sulfur dioxide. This removal should be done before the temperature reaches 900 C.

24652 APTIC NO. 45721

Kania, W. and A. A. Slinkin

THE ACTION OF AIR ACTIVATION AND SULFUR DIOXIDE REDUCTION ON THE MAGNETIC PROPERTIES OF ALUMINUM-CHROMIUM CATALYSTS. *(Vliyaniye aktivatsii vozdukhom i vosstanovleniya SO2 na magnitnyye svoystva alyumokhromovykh katalizatorov). Text in Russian. Kinetika i Kataliz, 13(2):529-531, 1972. 3 refs.*

Magnetic susceptibilities and electroparamagnetic resonance (EPR) spectra of aluminum-chromium catalysts were studied to determine the distribution of chromium (5+), chromium (3+), and chromium (6+) ions as a function of the oxidation and reduction temperatures. The catalyst, containing 13% of chromium trioxide by weight, was obtained by the joint precipitation of aluminum and chromium hydroxides. Both the oxidation in air and the reduction in sulfur dioxide atmosphere were done over 6 hrs at 250-650 C. The magnetic moment of samples oxidized at 450 and 550 C corresponded to one unpaired electron, and such samples contained very high amounts of Cr(5+) ions. The magnetic susceptibilities obtained were mainly due to the presence of Cr(3+) ions. The increase in the oxidation temperature to 650 C was accompanied by the appearance of wide EPR lines of Cr(3+) ions and by increases both in the number of the latter and the magnetic susceptibilities and magnetic moments. Samples reduced in SO2 atmosphere had high magnetic susceptibilities and moments compared to oxidized samples due to the increase in the number of Cr(3+) ions. The number of Cr(5+) and even of Cr(6+) ions was high at elevated reduction temperatures. Reduced catalyst samples contained many Cr(5+) ions, probably due to the presence in SO2 of small amounts of oxygen with Cr(5+) ions formed as a result. It is assumed that Cr(5+) ions are incorporated in active catalyst centers which are responsible for the oxidation of SO2 to sulfur trioxide.

24653 APTIC NO. 45423

Kawauchi, Bunkichi

GAS BOILER WITH MANY MERITS. *(Meritto no skii gasu sensho boira). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(9):57-61, Sept. 1972.*

A FTGN boiler with a high-speed burner is described. The high-speed burner has the following characteristics: combustion chamber capacity up to 150 million kcal/cu m/hr; high combustion gas emission velocity up to 200 to 300 m/sec; turn down ratio as high as 1/50; and possibility for combustion at 5000% excess air. A spiral stack which provides better contact for heat transfer was chosen for this particular boiler. Gas from the boiler contains no sulfur dioxide or particulates and has fewer nitrogen oxides than gas from a boiler with a different burner. Automatic control systems for gas and air supplies are installed, as well as for emergencies such as high pressure and high water levels in boiler or disconnection of electricity.

24654 APTIC NO. 45441

Kito, Shigehiro

PROBLEMS AND COUNTERMEASURES OF POLYVINYL CHLORIDE CONTAINING REFUSE COMBUSTION TREATMENT. *(Enbikei kongo haikibutsu no shokyaku shorijo no mondaiten to taisaku). Text in Japanese. PPM (Japan), 3(9):43-51, Sept. 1972.*

The combustion of refuse containing polyvinyl chloride (PVC) is described, including the details of a combustion furnace. Plastic refuse constituted 11% of the total trash in Japan in 1971; the percentage is expected to grow rapidly and reach 35% in 1980. Combustion of plastic refuse generates smoke, toxic gases, and large amounts of heat and causes damage to apparatus. Results obtained from the combustion of PVC in a furnace with a capacity of 60 kg/hr and equipped with a venturi scrubber show that the scrubber reduced the flue gas concentration of hydrochloric acid from 30,000 ppm to 600 ppm. To meet strict standards, double purifications with two consecutive venturi scrubbers are necessary.

24655 APTIC NO. 46200

Kramm, D. J.

SELECTION AND USE OF THE ROTARY LIME KILN AND ITS AUXILIARIES--II. *Paper Trade J., 156(35):25-31, Aug. 21, 1972.*

Auxiliary equipment and instrumentation used on kraft lime sludge kilns are discussed. A typical combustion gas and oil burner arrangement is depicted, and methods to produce the proper flame pattern are indicated. A recent development in the paper industry is the use of kiln-attached integral tube coolers for partial cooling of the lime and for return of this recovered heat to the kiln. Construction details and design criteria of these coolers are considered. Firing hoods, hot lime conveyors, the rotary kiln itself, and exhaust systems are described. In the cold fan exhaust system arrangement, the hot kiln gas first enters the feed end housing which may use sprays for preliminary clean-up of the gas, or which may have flushing pipes only for removal of dust fall-out. Gas then proceeds via ducting to the scrubber for dust removal, and then, having been cooled to about 170 F, clean gas passes through the fan and into a stack. In the hot fan arrangement, the hot gas first enters the feed end housing, and this housing will have flushing pipes only for easy removal of dust which collects in the bottom of the housing. In no event should the gas itself be spray quenched since this will cause build-up on the fan. Gas, still hot, proceeds by ducting to the fan, from which it is blown under pressure to the inlet of the scrubber. Feed end housing, screw feeders, the induced draft fan and damper, scrubbers, stone feeders, and ferris wheel feeders are described. Various instruments are discussed, including thermocouples, oxygen analyzers, flow meters, a gamma ray controller, and safety equipment. Some corrections for Part I of this article are included.

CONTROL METHODS

24656 **APTIC NO. 45629**

Kutenev, V. F. and V. N. Topunov

AUTOMOBILE CRANKCASE VENTILATION SYSTEM REQUIREMENTS FOR THE ABATEMENT OF TOXIC EXHAUSTS.

(Trebovaniya k sistemam ventilyatsii kartera avtomobil nykh dvigateley dlya umensheniya vybrosa tokischnykh veshchestv). Text in Russian. Avtomob. Prom., no. 6:3-5, 1972. 5 refs.

Engine crankcase ventilation system requirements were derived from experiments on the influence of different positive crankcase ventilation systems on the total amount of toxic matter in exhausts under different load conditions. Exhaust gas composition is considerably influenced by the air-excess coefficient and the specific type of positive crankcase ventilation system applied (recycling before or after, or before and after the carburetor). Total hourly hydrocarbon emission from engines with any type of positive crankcase ventilation decreased by 10-50%, depending on load, as compared to engines without exhaust recycling. Carbon monoxide emissions decreased by 10-50% for recycling after and increased by 20-40% for recycling before the carburetor, and were also dependent on the carburetor adjustment. Nitrogen oxides emissions increased by 10-50% for recycling after and decreased by 5-10% for recycling before the carburetor, depending on load. The benzo(a)pyrene concentrations increased by 2 to 15 times for any type of crankcase ventilation, primarily due to the carryover of oil droplets and vapors into the engine. The use of an oil filter in the crankcase gas recycling line resulted in a decrease of more than 50% in the benzo(a)pyrene emission. Reduced benzo(a)pyrene emissions with increased air-excess coefficients and its absence at coefficients above 1.03 were observed. The total amount of toxic exhaust components may decrease by 2-7% for recycling before the carburetor, but an increase of 9-19% is observed in most cases. A maximum increase of 4%, but mostly a decrease of 6-17% is observed in the case of recycling after the carburetor. A decrease of 10-50% in total unburned hydrocarbons may be accompanied by increases of 10-50% in CO, 5-50% in nitrogen oxides, and 200-1500% in benzo(a)pyrene emissions. These findings suggest the need for combined crankcase ventilation systems or systems with recycling after the carburetor, where the ventilation air must not exceed the exhaust volume, as well as for oil filters. The maximum proportion of the crankcase gas recycled before the carburetor in combined systems should be 30% under low loads and 40% under other load conditions.

24657 **APTIC NO. 46221**

Lawall, Thomas R. and Sidney M. Cohen

NITROGEN OXIDE EMISSIONS FROM A FLUIDIZED BED REACTOR.

Preprint. Fuller Co., Catasauqua, Pa., 16p., 1972 (?). 8 refs.

The rate of nitrogen oxide production in the combustion process of a fluid bed reactor was studied. Experiments were performed in both a fluid bed reactor and a rotary kiln, on an identical process, to compare emissions; a technique for sampling and analyzing reactor off-gas for nitrogen oxide and nitrogen dioxide content is described. The NO emissions from the rotary kiln were three times those in a fluidized bed reactor processing the same material at the same material temperature. As the stoichiometric air ratio increased, the difference became even greater. In higher temperature chemical processes, the fluidized bed reactor will significantly reduce the amount of nitrogen oxide emissions when compared to pyro-processing equipment which involve flame combustion.

24658 **APTIC NO. 46311**

Lemoine, Pierre

THE WAR ON POLLUTION. DESULPHURIZATION OF FUELS AND FUEL GASES.

Eurospectra, 11(1):8-11, March 1972. 6 refs.

Three major types of techniques for combating emissions of sulfur compounds during fuel combustion are surveyed: desulfurization of heavy residual fuel oils and of coals; gasification of coal and mineral oil followed by desulfurization of the gas produced; and desulfurization of combustion gases by dry and wet processes such as adsorption, absorption, manganese oxide, catalytic oxidation, and alkaline additives. Technical and economic problems in the current state of the art of these techniques are noted.

24659 **APTIC NO. 45679**

Leutert, Gerhard and Bruno Boehlen

THE SPATIAL DEVELOPMENT OF ELECTRIC FIELDS AND SPACE CHARGE DENSITY IN PLATE ELECTROSTATIC PRECIPITATORS.

(Der raeumliche Verlauf von elektrischer Feldstaerke und Raumladungsdichte im Platten-Elektrofilter). Text in German. Staub, Reinhaltung Luft, 32(7):297-301, July 1972. 14 refs.

A method for calculating the spatial development of electric fields in plate electrostatic precipitators is described. The effect of space charge density (q) on the development of electric field intensity (E) is completely taken into consideration. For the calculation, the fundamental equations of electrodynamics are used as the starting point. The resulting differential equations are numerically solved by a digital computer. The method gives values for E and q for the whole space charge zone of a plate electrostatic precipitator and can be used for any current. The field intensity develops in the plate electrostatic precipitator in a basically different manner than in the tubular filter. The development of field intensity is changed decisively by the space charge density.

24660 **APTIC NO. 45811**

Lorenzi, L., Jr., J. S. Land, J. L. Van Nice, and R. A. Meyers

ENGINEERING, ECONOMIC, AND POLLUTION CONTROL ASSESSMENT OF THE MEYERS PROCESS FOR REMOVAL OF PYRITIC SULFUR FROM COAL.

Preprint, American Chemical Society, Washington, D. C., Div. of Fuel Chemistry, 12p., 1972. 4 refs. (Presented at the American Chemical Society, Division of Fuel Chemistry, Symposium on Environmental Pollution Control, New York, Aug. 29-31, 1972.)

The engineering and economic feasibility of the Meyers process for converting current steam coal production to a sulfur level consistent with federal regulations for controlling sulfur dioxide emissions from stationary sources is assessed. The process consists of pyrite leaching with ferric sulfate solution; regeneration of the ferric sulfate leach solution; coal washing with water; and sulfur recovery by solvent extraction and coal drying. The overall processing cost for the baseline pyritic sulfur removal process was estimated at $1.95/t of coal; capital, labor, equipment, installation, and operating costs were also calculated.

24661 **APTIC NO. 45709**

Lutes, J. M. and Richard A. Nichols

NEW UNIT RECOVERS GASOLINE VAPORS.

Oil Gas J., 70(3):119, July 31, 1972.

A compact unitized hydrocarbon-vapor-recovery system was developed which satisfies federal emission regulations and effects an economic return. Basically, it is an on-stream, low-pressure, low-temperature automatic system based on absorption. The unit consists of a vent gas entry, saturator-flash separator, vapor- saver connection, compressor, aftercooler module, heat exchanger, refrigeration module, and absorber. The basic operating principles and design are reviewed. An unusual feature of the refrigeration system is the use of processing gasoline rather than water as coolant for the condenser. The system is expected to recover a minimum of 90% of incoming vapors under normal operating conditions; test values have reached to 95% and greater recovery efficiency.

The unit is applicable to tank filling or gasoline storage facilities.

24662 **APTIC NO. 45409**

Machida, Yuzuru and Yoshihiro Shigeta

DISCUSSION OF ODOR CONTROL MEASURES AGAINST KRAFT PULP. *(Kurafuto parupu no okushu taisaku o kataru). Text in Japanese. Akushu no Kenkyu (Odor Research J. Japan), 2(7):57-65, Aug. 1972.*

The occurrence and control of offensive odors from kraft pulping is discussed. The sources of odors from kraft pulp are the three major stages during the course of manufacturing. The first stage is the boiling-decomposition of raw materials, the second stage is the evaporation for the recovery of black liquor, and the third stage is the evaporating system including the boiler. The main source is the first stage, and the odor concentration depends largely on the sodium sulfide content in the reagents. The control at the first stage is usually carried out by continuous high temperature washing or batch distillation.

24663 **APTIC NO. 46132**

Malov, D. I., V. V. Podsevalov, A. S. Dzhobadze, P. A. Lupanov, A. B. Moshkovich, and A. E. Kostin

AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES. *Intern. Chem. Eng., 12(3):484-487, July 1972. 5 refs. (Also appeared in Khim. Prom., no. 12:34-36, 1971.)*

An investigation was undertaken to determine the principal controlling and perturbing actions, as well as the static and dynamic combustion furnace characteristics, for burning the organic wastes from the production caprolactum. Pot residues, dicarboxylic acid, and waste water are introduced into the upper and lower furnace zones with the aid of special jets. The required combustion conditions are maintained by varying the amount of natural gas supplied to the upper and lower furnace zones, as well as the overall and upper furnace zone air consumption. Increased darkening of the off-gases indicates lowering of the extent of combustion. Controlling parameters are enumerated. Determination of the basic controlling and perturbing actions was carried out using correlation pair coefficients. Analysis of the statistical data collected and of the reliable correlation pair coefficients is presented.

24664 **APTIC NO. 45373**

Marsheva, V. I., G. K. Boreskov, and V. D. Sokolovskiy

THE MECHANISM OF CARBON MONOXIDE OXIDATION OCCURRING ON METAL OXIDE SURFACES. I. STUDYING THE GRADUAL PROCESS OF CARBON MONOXIDE OXIDATION ON VANADIUM PENTOXIDE SURFACES. *(Mekhanizm okisleniya okisi ugleroda na okislyakh metallov. I. Issledovaniye stadiynosti okisleniya okisi ufleroda na pyatiokisi vanadiya). Text in Russian. Kinetika i Kataliz, 13(2):393-398, 1972. 15 refs.*

The initial rates of the catalytic oxidation of carbon monoxide and of reactions of oxygen and CO with vanadium pentoxide at 300-450 C were studied. The catalyst oxidation and regeneration rates were similar and lower than the rate of catalysis by about one order of magnitude. The activation energies for the regeneration, oxidation, and catalytic processes were 16-17 kcal/mol, i.e., the temperature-dependence of all three processes was identical. The rates of regeneration and oxidation for stationary catalyst were a linear function of the oxygen and CO pressures at very low values. The rate of regeneration of V2O5 decreased with increased regenerability, while the rate of oxidation was a quadratic function of the regenerability. Adsorption of a small quantity of oxygen at very high rate, and the release of nearly equivalent carbon monoxide immediately after oxygen admission, was observed. The rate of oxidation as determined for 300 C and an initial oxygen pressure of 0.4 torr was 350 million molecules of CO/sq cm/sec. While the contribution of the oxidative-regenerative mechanism within the process of CO oxidation on V2O5 is only some 10%, the principal reaction mechanism most probably includes a phase of interaction between adsorbed CO and oxygen, not incorporated in the oxide lattice.

24665 **APTIC NO. 45644**

Mattersdorf, Ernst

REMOTE HEAT SUPPLY ON THE BASIS OF GAS BY REMOTE HEATING PLANTS OR HEATING CENTERS FROM THE OPERATIONAL POINT OF VIEW. *(Fernwaermeversorgung auf Basis Gas durch Heizwerke und Heizzentralen aus betrieblicher Sicht). Text in German. Energie Technik, 24(7/8):223-228, 1972. 8 refs.*

Power production by coal-fired plants produced so much waste heat that the use of the heat for home heating in the vicinity of the power plant became economical. In the past 2 yrs, central and remote heating has experienced a considerable rise due mainly to the availability of low priced fuel oil and natural gas. The latter experienced a 20% growth rate. Since natural gas has no sulfur components, the waste gas is free of sulfur dioxide. Moreover, natural gas has no carbon monoxide and is thus nontoxic. Relatively lightweight gas heaters can be installed on the roof of apartment houses. The seasonal and diurnal fluctuations of heat demand are discussed, as are the types of boilers and burners available. The combustion efficiency of a burner is determined with the aid of the nominal capacity. It provides information concerning the carbon dioxide concentration of the waste gas and the waste gas temperature. Combustion efficiency is 85-90% for atmospheric burners and 90-95% for blow-pipe burners.

24666 **APTIC NO. 46335**

Meerovskaya, V. I., R. Z. Khiterer, and Ye. A. Kazakova

EFFECT OF CO2 ON ADSORPTION OF NITROGEN PEROXIDE BY SILICA GEL FROM DRY NITROSE GAS. *Sov. Chem. Ind. (English translation from Russian of: Khim. Prom.), 4(1):35-38, Jan. 1972. 5 refs.*

As part of a method to produce nitric acid by direct oxidation of atmospheric nitrogen to nitric oxide in a steam generator at up to 10 atm pressure, low-concentration nitrogen oxide gases are enriched by adsorption on silica gel, and waste gases not containing carbon dioxide are purified. However, nitrogen oxides produced in the steam generator contain approximately 5.5% CO2. Experiments were conducted to provide data lacking in the literature on the effect of CO2 on the adsorption process. The studies were conducted at atmospheric pressure over a range of CO2 concentration of 8.8-100% at 20 and 0 C. Carbon dioxide was adsorbed in a fluidized bed of pre-dried silica gel; the amount of CO2 adsorbed was determined by gravimetry. Carbon dioxide adsorption increased with a drop in sorption temperature and with a rise in CO2 concentration in the initial gas. The relevant Langmuir-type equations are presented. The results make it possible to calculate a multistep adsorber of nitrogen oxides containing CO2 and nitrogen dioxide. An example is demonstrated. The CO2 substantially decreases the adsorbent capacity relative to NO2 in the upper regions of the adsorption column.

24667 **APTIC NO. 45719**

Mitachi, Kazuo

INCINERATION TREATMENT METHOD OF ORGANIC WASTE CONTAINING CHLORINE. *(Enso o fukumu hai yukibutsu no shokyaku shori hoho). Text in Japanese. (Nittetsu Kakoki (Japan)) Japan. Pat. Sho 47-30518. 3p., Aug. 8, 1972. (Appl. Dec. 30, 1967, 1 claim).*

Organic liquids or gases containing chlorine are led into the burner section of an incinerator and mixed with a suitable amount of air required for combustion. The burner should be a high-speed, short-flame burner. By adjusting the combustion air quantity and maintaining the temperature of the incinerator at a given point, the organic matter will be completely decomposed and chlorine will become hydrochloric acid steam. The combustion gas is jet sprayed into a sulfuric acid solution bath, where heat exchange is achieved. While gas is cooled, the sulfuric acid solution evaporates and the acid concentration increases. The sulfuric acid concentrate is sent to the extraction distillation process. The cooled gas is led to the absorption tower where water is showering down all the time. Hydrochloric acid steam is absorbed in water and becomes 16 to 18% concentrate or even closer to azeotropic composition. Nitrogen and carbon monoxide steam from the absorption tower are sent to a detoxitizing tower, where a dilute alkaline solution neutralizes the small amount of remaining hydrochloric acid. The hydrochloric acid extracted from the bottom of the absorption tower is mixed with the sulfuric acid concentrate and flash distillation is given. The steam from the top of the distillation tower is condensed and becomes a highly pure hydrochloric acid concentrate. The dilute sulfuric acid from the bottom of the tower is sent to the heat exchanger and concentrated by combustion gas.

24668 **APTIC NO. 45658**

Mityushkin, V. G. and V. I. Var yev

MODIFICATION OF THE COKE GAS PURIFICATION ELECTRICAL FILTER DESIGN. *(Rekonstruktsiya elektrofil tra dlya ochistki koksovogo gaza). Text in Russian. Koks i Khim., no. 4:38-39, 1972.*

A modified electrical filter design for use in cokeries for the separation of tar from coke gas is described. The hermetically sealed cylindric electric filter provides possibilities to minimize electricity and heat consumption, to simplify maintenance procedures, and to stabilize the temperature of the insulators. The hermetically sealed design was made possible by applying two coupled insulators, the upper one of which is sealed by mastic, as well as by mounting the suspension insulators for the discharge electrodes frame inside the electrostatic filters. To avoid tar condensation on insulators, the latter are placed in the center of the gas flow.

24669 **APTIC NO. 45394**

Morita, Tomijiro

THE WASTE GAS DESULFURIZATION BY KUREHA SYSTEM. *(Haien datsuryu - Kureha kagaku ho). Text in Japanese. Seikyu Gakkai- Shi (J. Japan Petroleum Inst., Tokyo), 15(7):569-572, July 1972. 6 refs.*

The Kureha waste-gas desulfurization process involves absorption and crystallization, and recovers sodium sulfate as the by-product. The performance of the absorption device and the quality of the by-product was first studied in an experiment with an oil-fired burner emitting 250 cu nm/hr of stack gas. A pilot-plant test, in which the stack gas emission was 1500 cu nm/hr, was then conducted to determine the best measures for uniform dispersion of the absorbent solution in the layers of the packed tower, for rectification of gas flow, and for prevention of white smoke. Additional objectives of the pilot-plant test were to determine if absorbent pH, gas mass velocity, and liquid/gas ratio at levels found suitable in the basic experiment would achieve the desired absorption efficiency: an existing sulfur dioxide concentration of 30 ppm when entrance concentration was 1500 ppm. Based on the findings of these basic and pilot-plant experiments, two practical versions of the Kureha desulfurization device were constructed. One was designed to handle 300,000 cu nm/hr of boiler emission gas and the other 28,000 cu nm/hr. Absorption efficiency was 99.1% when SO_2 entrance concentration was 910 ppm and gas emission was 181,000 cu nm/hr. It was 97.9% when entrance SO_2 concentration was 1450 ppm and gas emission was 181,000 cu nm/hr. The dust-removal efficiency and wind pressure loss evaluated are shown in tables.

24670 **APTIC NO. 45641**

Mukhlenov, I. P., L. N. Gur yanova, and Ye. I. Dobkina

HYDROGEN SULFIDE CONVERSION ON PALLADIUM CATALYST. *(Prevraschcheniye serovoroda na palladiyevom katalizatore). Text in Russian. Khim. Prom. (Moscow), no. 1:116-118, 1972. 6 refs.*

The degree of hydrogen sulfide conversion on a palladium catalyst (aluminum oxide with 2% of palladium by weight) and the effects of different factors on the degree of conversion were studied. The H_2S concentration in the H_2S-air mixture ranged from 0.085 to 0.88%, and a temperature range of 130-250 C was applied with different flow rates and a humidity of 50%. The degree of conversion was a function of time, but independent of the concentration; the influence of the amount contacting the catalyst was observed. Three different phases in the variations of the conversion were distinguished. After zero H_2S concentration, a critical quantity whose magnitude was dependent on both the temperature and the flow rate, caused the activity to decrease. Both H_2S and its oxidation products were sorbed by the catalyst. A second phase, where sulfur dioxide and water, as well as traces of sulfur vapor were the catalytic products, was characterized by gradual poisoning of the catalyst and increasing SO_2 concentrations. The degree of conversion, dependent on the temperature and the flow rate, stabilized around a constant value in a third phase. The degree of conversion showed monotonous increase in a temperature range of 130-200 C, to increase abruptly above 200 C. The total S left the catalyst in the form of SO_2 and H_2S. The catalyst poisoning was probably due to the blocking of active centers by S, primarily in the first phase. The pore volume decreased with the time and the labile equilibrium between S concentration and the concentration of the stable final product (SO_2). The catalyst poisoning observed in a temperature range of 130-250 C indicates that the process of the catalytic oxidation of H_2S should be conducted at temperatures above 300 C, or else periodic regeneration by means of an air blast should be applied.

24671 **APTIC NO. 45411**

Nagata, Katsuya

A CONTROL PLAN FOR NO_X EXHAUSTED FROM BOILER PLANTS. *(Boira ni okeru NO_x no yokusei taisaku). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(9):8-16, Sept. 1972. 15 refs.*

Methods for possible control of nitrogen oxides emission from a boiler are described. The possible control methods can be classified into four categories, namely, the controls by changing operation condition, combustion method, fuel, and shape of combustion chamber. For large scale boiler such as that being used at power plants, decreasing air ratio reduces the NO_x emission. However, there are boilers which have the opposite effect or have lower NO_x emission both at low and high air ratio. Other possible control methods include reducing heat loading of a combustion chamber and preheating air for combustion, improvements of burner and air register, two stage combustion, flue gas recycling, off-stoichiometric combustion, and water or steam spraying.

24672 **APTIC NO. 46141**

Nakamura, Takeshi, Keijiro Nakagawa, and Sangoro Ayuzawa

DUST COLLECTION FOR METAL SILICON MANUFACTURING. *(Kinzoku keiso seizo ni okeru shujin ni tsuite). Text in Japanese. Feroaroi (Ferroalloy), 21(1):46-57, 1972. 12 refs.*

Dust collection for metal silicon manufacturing has to remove dust which has an extremely small size diameter. The temperature in the hearth is estimated to be 1800-2000 C. The amount of gas in the hearth, the amount of dust, and the energy which controls the temperature of the waste gas can be estimated. The loss of silicon monoxide gas to silicon dioxide dust has a range of 0.4-10 g/N cu m and the average is about 2.5 g (under the condition of 120,000 N cu m/t of manufacture waste gas). Since metal silicon manufacturing uses an open hearth, the gas produced in the hearth is combusted with the air and diluted. Thus, the gas is heated to a high temperature and expands. For the base of installation of the dust collection device there is a correlation chart to estimate the disposal gas amount. A graph shows the change of the temperature and the change of gas with time befory the installation of the dust collection devices. The waste gas temperature varies according to the manufacturing process. The concentration and properties of dust before the installation of dust collection devices were checked. In metal silicon manufacturing the amount of dust varies periodically, and the temperature of waste gases changes accordingly. At the stable period of the operating hearth, the dust concentration was 0.4-0.7 g/N cu m, but at the blowing point, it was 7-10 g/N cu m. The relation between gas temperature and dust concentration using a new device was measured. The pressure damage at temperatures of 200-250 C was measured. A cycling hood was invented which has smaller open space than conventional one. The relation between gas temperature, filter pressure damage, and filter velocity is discussed. The cooling method for waste gas, installation problems for dust devices, and treatment of dust are discussed.

24673 **APTIC NO. 45451**

Nelson, W. L.

STATUS OF RESIDUAL DESULFURIZATION. *Oil Gas J., 70(31):98-100, July 31, 1972. 32 refs.*

Processes for desulfurizing residual materials are: Isomax of Chevron Research Co., or Universal Oil Products Co.; HDS (hydrodesulfurization) of Gulf Research and Development Co.; and H-Oil of Hydrocarbon Research Inc. and Cities Service Research and Development Co. The following processes are being actively developed: Residfining of Union Oil Co. of California and Esso Research and Engineering Co.; IFP of Institut Francaise du Petrole; and the BP process of British Petroleum. However, at the moment there is a major difficulty, in that only residues which contain less than 100 or possibly 150 ppm of vanadium and nickel can be handled profitably. All of the processes employ catalysts, recirculate hydrogen, and employ fixed-bed reactors except the H-Oil process which has its own ebullating bed reactor. The processes and sulfur reduction are discussed, including the problem of deactivation of the catalyst by the metals.

24674 **APTIC NO. 46381**

Nieuwenhuizen, J. K., C. W. J. van Koppen, and F. Dijkstra

INCINERATION OF GASEOUS AND LIQUID WASTES. *(Verbrandning van gasvormige en vloeibare afvalstoffen). Text in Dutch. Ingenieur, 84(28/29):A619-624, July 1972.*

Problems of the incineration of gaseous and liquid industrial wastes are discussed with special regard to flares. High flares are preferred to ground flares, since the latter may emit harmful waste gases near the soil surface, in addition to being fairly expensive. Steam injection into the flare gas has several advantages. Problems of flare generated noise are described, and a method for the calculation of the acoustic frequency as a function of the flare outlet rate and the flare opening diameter is given. Diffuse flames generate a much lower noise level than mixed flames. Experiments on the effect of different wind speeds on natural gas pilot flames are described. An experimental, 100,000 kcal/hr capacity incinerator for gaseous and liquid wastes incineration studies is presented. The incineration is done in a cylindrical, horizontal combustion chamber combined with a catalytic reactor for peak loads. Universal burners for gas and oil are installed. The flue gases are discharged after dilution.

24675 **APTIC NO. 46159**

Ohara, Takashi

PRODUCTION OF ACRYLIC ESTER AND ITS ECONOMICS--PROPYLENE OXIDATION PROCESS. *Chem. Economy Eng. Rev., 4(7):24-29, July 1972. 7 refs.*

Since 1960, attention has been drawn to acrylic ester as a propylene derivative, with a rapid progress having been made in research and development work on the direct oxidation of the propylene. This process, including the separation and purification steps, boasts a high level of technology. Technical and economic problems pertaining to the direct propylene oxidation process in comparison with conventional processes are discussed. The market for acrylic ester is considered, as well as the history of acrylic ester processes. These include the ethylene cyanhydrin process, the modified Reppe process, high-pressure Reppe process, the ketene process, and the acrylonitrile hydrolysis process. The direct propylene oxidation process is described in detail, including pollution control. Small amounts of acrolein, carbon monoxide, propylene, and propane can be easily burned in an incinerator, and the heat generated by the burning can be recovered in the form of steam.

24676 **APTIC NO. 46155**

Ohigashi, Shunichi, Hiroshi Kuroda, Yasuo Nakajima, Yoshimasa Hayashi, and Kunihiko Sugihara

PRACTICAL ANALYSIS OF EFFECT OF EXHAUST GAS RECIRCULATION ON NOX CONTROL. *(Bull. JSAE (Japan Soc. Mech. Engrs.)), no. 4:58-65, 1972. 6 refs.*

Exhaust gas recirculation (EGR) decreases peak combustion temperature and reduces the concentration of nitrogen oxides in spark ignition engine exhaust gas. It is hypothesized that NOx formation is primarily affected by the heat capacity of the combustion gases and recycled exhaust gas. The hypothesis was tested in an experimental program involving admission of inert gases such as helium, argon, carbon dioxide, and water in place of EGR. In addition to confirming the validity of the original hypothesis, the test data also indicated that engine output and efficiency were significantly affected by the heat capacity of the combustion gases. It was concluded that EGR functions by increasing the heat capacity of the working fluid and that correlative changes in NOx and engine performance can be predicted from heat capacity considerations. These studies, together with further work on combustion pressures, will be useful in evaluating various NOx control techniques. (Author summary modified)

24677 **APTIC NO. 46165**

Okuyama, Kikuo, Jun Emi, and Ryoji Yoshimoto

THE EFFECT OF MUTUAL INTERFERENCE OF FIBERS IN AN EXPERIMENTAL FIBER PACKED LAYER FILTERING PROCESS. *(Moderu sen-i jutenso roka ni okeru sen-ikan sogo kansho koka). Text in Japanese. Preprint, Japan Society of Chemical Engineering, Tokyo, p. 213-215, 1972. 11 refs. (Presented at the Japan Society of Chemical Engineering, Annual Meeting, 37th, Nagoya, Japan, 1972.)*

The gap rate and non-uniformity of fibers affect mutual interference of fibers in the fiber packed-layer filtering process. However, the degree of the effect of interference depends on the mechanism of collection and some studies have been done theoretically and experimentally. In order to study the effect of the mutual interference of fibers in an area of inertia, a starting point was obtained as a function of gap rate, following Lamb's theory, and it was compared with the results of Stechkin and Stenhouse and also with the result of an experiment for a model filter. The flow model in the cylinder group is presented in a diagram. The mathematical calculation method for the effect of interference was discussed and the result was compared with other studies. The experiment was conducted with a model filter. The data of uni-cylinder inertia blocking efficiency was compared with theoretical values. The experimental data was considerably lower than the theoretical.

24678 **APTIC NO. 46140**

Opalko, Stanislaw

THE CHEMICAL INDUSTRY S STRUGGLE AGAINST ENVIRONMENT POLLUTION - NITROGEN WORKS IN TARNOW AS AN EXAMPLE. *(Przemysl chemiczny w walce z zanieczyszczeniem srodowiska na przykladzie Zakladow Azotowych w Tarnowie). Text in Polish. Przemysl Chem., 51(5):278-281, 1972.*

In 1970 the ratio of non-polluted to polluted rivers in Poland was 8:1 and it is estimated that this ratio will change to 4:1 in 1985. Atmospheric pollution in 1970 was 740 t/day dust, 1270 t/day gases; by 1975 it will be 780 t/day dust and 1450 t/day gases. Total production at the nitrogen works in Tarnow increased from 100,000 tons in 1960 to 390,000 tons in 1970. The amount of money allocated to fight pollution in 1960-1970 will double in 1970-1975. The money is used for biological purification from phenol and its derivatives resulting in a BZT5 concentration of 200-235 mg/l and of phenol equal to 0.1-0.5 mg/l; for chemical purification of cyanide pollution including a new method of destruction of the cyanide ion by means of active chloride resulting in a cyanide ion concentration of 0.5-2 mg/h. In addition, a central waste purification plant was built which employs a coagulation method using aluminum sulfate, lime, and different precipitation methods and results in a 70% reduction of suspended particles. The large investments for control of pollution resulted in a significant decrease in the rate of pollution of the Dunajec river. New methods for the use of different kinds of waste such as ash, slag, carbide lime, and all kinds of sediments and residues are being investigated. Slag is used as fill and for recultivation of large gravel excavations. Carbide lime can be utilized (after drying) in the building industry and for production of high grade precipitated chalk for the rubber and plastics industry. Experiments for the use of soot in metallurgy are currently being investigated. Biological purification plants, will be installed for industrial and municipal (Tarnow) waste products. Plans for the control of emissions into the atmosphere are also in progress.

24679 **APTIC NO. 46267**

Niels Gram, Paul Bergsoe and Son A/S (Sweden), Lars Pehrzon, and Carl-Johan Gothe

LEAD IN GASOLINE. *(Bly i bensin). Text in Swedish. Mod. Kemi, no. 3:31-34, 1972.*

The problems of adding lead to gasolines in Sweden and the health aspects of lead are outlined. Problems and possible consequences of a ban on lead are discussed. Both the combustion of hydrocarbons and the lubrication of the valves are improved by lead, for which no comparable substitute has yet been found. Replacing lead by olefins or aromatic additives would increase the smog formation and cause 13 times as high a content of unburnt hydrocarbons and five times as high concentrations of carbon monoxide as compared to lead-treated fuel, while engine output would decrease by 36% with 25% higher fuel consumption. Applying lower compression rates, resulting in 5-10% decrease in output and 5-10% increase in fuel consumption, is not sure to reduce the amounts of unburnt hydrocarbons and carbon monoxide. A maximum allowable lead content of 0.4 g/l of gasoline will be imposed in Sweden as of 1973, and further reductions are envisaged. Although the Swedish petroleum industry is prepared for the reduction, more than 50% of the gasoline is imported, which makes international cooperation necessary. Different investigations revealed lead accumulated in bones and in body fluids in stable concentrations. The blood lead level is closely correlated to the degree of exposure. These levels in Swedish populations were found to be 15 and 10-12 micrograms/100 ml for males and females, respectively. These and other data suggest the non-existance of health hazards from lead in Sweden.

24680 **APTIC NO. 46151**

Potter, B. H. and T. L. Craig

COMMERCIAL EXPERIENCE WITH AN SO2 RECOVERY PROCESS. *Chem. Eng. Progr., 68(8):53-54, Aug. 1972.*

The Wellman-Lord sulfur dioxide recovery process is now successfully treating tail gas from three dissimilar types of plants both here and abroad. The first unit was designed to treat 45,000 std cu ft/min of sulfuric acid regeneration plant tail gas containing up to 6000 ppm SO2. The clean gas, containing less than the guaranteed maximum of 500 ppm SO2, is discharged to the atmosphere. Product SO2 is returned to the acid regeneration plant for sulfuric acid production. The second Wellman-Lord SO2 recovery unit is sized to treat 200,000 cu m N/hr of stack gas from an oil fired boiler which uses a fuel having a sulfur content of 4.0-4.2%. It has consistently reduced SO2 levels from about 2000 to less than 200 ppm by volume. The third Wellman-Lord unit was installed on a Claus plant incinerator. The absorber in this application is composed of a pre-scrubber section and two SO2 absorption stages, each comprised of two sieve trays. Some novel features of the unit include glass-lined evaporators, ceramic booster compressors, purge treatment, and a chemical additive for reduction of sulfate formation in the absorber. Plant operation is described for each of the units.

24681 **APTIC NO. 45634**

Pyldra, A. P., M. V. Rak, N. A. Gnatyuk, and V. F. Semikov

MN TYPE GAS ANALYZER ALIGNMENT FOR THE AUTOMATIC CONTROL OF THE AIR REGIME IN OPERATING BOILERS. *(Opyt naladki gazoanalizatorov tipa MN dlya kontrolya i avtomaticheskogo regulirovaniya vozdushnogo rezhima kotla). Text in Russian. Energetik (Moscow), no. 6:22-23, 1972.*

Gas analyzers designed for combined waste-gas oxygen monitoring and automatic air-supply control and their hook-up to the boiler system are described. The gas analyzer is preceded by a water-jet gas purifier, a gas separator, and a gas cooler to increase reliability and to minimize maintenance. The water ejector, consuming turbine condensate at a rate of 0.05-0.06 t/hr under a pressure of 3-4 atm, removes practically all aggressive contaminants from the gas flow. The retardation of the signal transmission is 5-7 sec. The formation of spurious signals is avoided by the application of contactless hook-up. The accuracy of the stabilization of an average oxygen concentration in the flue gas for 100% and 60% loads is plus or minus 0.1% and plus or minus 0.15%, respectively.

24682 **APTIC NO. 45417**

Raskin, A. Ya., Yu. A. Sokolinskiy, and V. I. Mukosey

OPTIMIZATION OF CARBON MONOXIDE CONVERSION REACTOR DESIGN. *(Optimal noye proyektirovaniye reaktorov konversii okisi ugleroda). Text in Russian. Khim. Prom. (Moscow), no. 4:282-285, 1972. 15 refs.*

A mathematical model for the optimization of the design of two-stage, adiabatic carbon monoxide conversion reactors is given. Minimizing the catalyst expenditure and determining an optimum relation between the volumes of both stages as well as the minimum catalyst grain size are the basic objective of the optimization. Formulae describing the CO conversion reaction for medium-and high-temperature catalysts, and the reaction rates as a function of the diffusion retardation on catalyst grains, are given. Formulae for calculating the material and thermal balances in the catalyst layer, the necessary catalyst volume in the second stage, and the hydraulic resistance in both stages are derived. The optimization of a reactor design, performed by means of computer, resulted in a decrease of nearly 20% in the catalyst expenditure due to optimization of the catalyst grain size. The above design method can be extended to CO conversion reactors with more than two stages.

24683 **APTIC NO. 45640**

Rathgeber, Ferdinand

METHODS AND EQUIPMENT FOR THE ELIMINATION OF HARMFUL MISTS AND VAPORS. *(Verfahren und Anlagen zur Beseitigung schaedlicher Duenste und Daempfe). Text in German. Wasser, Luft Betrieb, 16(8):253-259, Aug. 1972.*

Methods for elimination of harmful vapors and mists that develop at numerous industrial production processes are reviewed. They are mechanical separation, electric separation, wet separation and absorption, thermal combustion, catalytic combustion, and adsorption on activated coke. The most efficient method for separation of undesired waste gas components is in many cases the scrubbing of the gases. A scrubber with an additional venturi stage permits a good adjustment to the respective tasks. With more difficult cases the gas is sent through a scrubber equipped with a layer of freely moving hollow spheres. If the waste air contains organic components and solvents, the undesired pollutants can be removed by thermal or catalytic combustion. For the waste gas cleaning in smaller plants, small activated coal plants are available with a maximum air throughput of 520 cu m/hr. Eighteen cleaning units are illustrated.

24684 **APTIC NO. 46378**

Resplandy, A.

AIR POLLUTION DUE TO SULFUR DERIVATIVES EMITTED DURING PULP MANUFACTURE. II. SULFATE PULPING PROCESSES. *(Pollution atmospherique par les derives du soufre emis au cours de la fabrication des pates. II. Les procedes au sulfate). Text in French. ATIP, 26(3):175-190, March 1972. 160 refs.*

Studies concerning the emission of sulfur compounds during the various stages of the sulfate pulping processes, and methods applied to control such emissions, are reviewed. Malodorous thio derivatives and hydrogen sulfide from boilers and blow-tanks can be incinerated in special or calcinating furnaces or auxiliary or waste heat boilers, or be chlorinated in alkaline or acid medium in gaseous phase or in solution. Three-stage treatment including preliminary oxidation, direct chlorination, and scrubbing with chlorinated water is also applied. Scrubbing with a spray of soda solution, with sulfite liquor followed by treatment with chlorine gas, and treatment with sodium plumbite solution are also used. Experiments with ozonization and adsorption on activated carbon, polyvinyl chloride, or iron oxides are being conducted. Blow tank condensates, containing thio derivatives, resins, oils, alcohols, ketones, phenols, terpenes, and toluene, can be subjected to chlorine treatment with partial oxidation, or stripping with vapor or water, followed by incineration. Gaseous emissions from lump separators, filters, and boilers usually contain few thio derivatives, while the low-volume emissions from multiple-effect evaporators are rich in H2S, methyl mercaptan, dimethylsulfide, and dimethyldisulfide. The direct process of black liquor thickening causes formation of H2S and methyl mercaptan due to the contact with sulfur dioxide and carbon dioxide. The residual H2S concentrations in waste heat boiler flue gases are 1 ppm, and those of SO2 are 20 ppm, corresponding to 0.01 kg/ton of pulp. Particulate emissions, mostly sodium sulfate and carbonate, emitted at a rate of 1-3 kg/ton of pulp, can be controlled by dry electrostatic precipitators, possible with electrodes wetted by diluted black liquor. The precipitator efficiencies are at 93-97%. Waste gas scrubbing with alkaline spray or black liquor, providing favorable dispersion conditions, and the denaturation of malodorous emissions are among the techniques applied in the sulfate process. Waste gases from calcinating kilns, emitting mostly dust and H2S, can be purified by scrubbers. Processes for the recovery of thio derivatives such as dimethylsulfide, dimethylsulfoxide, and methyl mercaptan from black liquor are available.

24685 **APTIC NO. 46175**

Sakai, Yasuo, Naomi Tokura, Saburo Tsutsumi, and Kosaburo Mukai

INFLUENCE OF ENGINE DESIGN FACTORS ON EXHAUST EMISSIONS FROM AUTOMOTIVE GASOLINE ENGINE. *Bull. JSAE (Japan Soc. Automot. Engrs.), no. 4:49-57, 1972. 3 refs. (Also: Trans. Soc. Automotive Engrs. Japan, no. 1, 1970.)*

A single cylinder engine was utilized to determine the effects of major engine design factors--stroke volume, stroke bore ratio, and compression ratio--on exhaust emissions. As the combustion chamber surface area to volume ratio increases, the hydrocarbon concentration increases while the nitric oxide concentration tends to decrease. A lower compression ratio, longer stroke, and larger stroke volume cause the HC concentration to decrease. However, with an extremely short stroke, the HC concentration also tends to decrease in spite of the larger surface area to volume ratio, assuming high speed conditions where HC oxidation is promoted. In order to decrease the NO concentration, it is desirable to decrease the compression ratio, stroke bore ratio, and stroke volume for each cylinder. (Author conclusions modified)

24686 **APTIC NO. 45412**

Sakanishi, Jun

EQUIPMENT FOR DESULFURIZATION OF FLUE GAS BY WET CALCIUM METHOD. *(Shisshiki karushiumuho haien datsuryu setsubi). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(9):23-29, Sept. 1972.*

The details of flue gas desulfurization by the wet calcium method are given. The boiler has a capacity of 490 t/hr and the generated steam is at 569 C and 173.5 kg/sq cm. The generator has an output of 174,000 KVA. Fuel used for the combustion is low grade coal powder which contains 2.2% sulfur. An electrostatic precipitator and a two-staged scrubber are used for the dust elimination and desulfurization of flue gas. The scrubber has a capacity of 385,000 N cu m/hr, and gas inlet and outlet pressures are 450 mm Aq and 40 mm Aq, respectively. It is designed for more than 90% desulfurization and dust removal. The sulfur dioxide is recovered as gypsum by using carbide residue (Ca(OH)2) as an absorbent. After 4 months of operation, the equipment is proved to be satisfactory.

24687 **APTIC NO. 45682**

Sano, Hiroshi, Toru Sakaguchi, and Katsutoshi Tanaka

A METHOD OF SEPARATING AND CONDENSING SULFUR DIOXIDE BY A POLYVINYL CHLORIDE DIAPHRAGM CONTAINING DIOCTYLPHTHALATE. *(Jiokuchirufutareto ganyu pori-enka biniru kakumaku ni yoru aryusan gasu bunri noshuku-ho). Text in Japanese. (Ministry of International Trade and Industry, Tokyo (Japan), Agency of International Science and Technology) Japan. Pat. Sho 47-23785. 3p., July 1, 1972. (Appl. March 18, 1970, 1 claim).*

This invention relates to the removal, condensation, and purification of sulfur dioxide in flue gas by polyvinyl chloride (PVC) containing dioctyl phthalate (DOP). With PVC film containing 20-50% DOP, the SO2 transmission rate is much faster than that of air, and the difference enables SO2 to be easily separated. Air containing 10% SO2 was passed through an 80-micron-thick PVC film containing 35% DOP immersed in a caustic soda solution. Results showed that the purified gas contained 0.5-1% SO2. Gas containing 30% SO2, 30% hydrogen, and 40% nitrogen was passed through a 60-micron-thick PVC film containing 45% DOP that was not immersed in sodium hydroxide solution. The transmitted gas contained 91% SO2, 7% H2, and 2% N2.

24688 **APTIC NO. 45429**

Sato, Etsuro

THE COOLING METHOD FOR FERROALLOY OPEN ELECTRIC FURNACE EMISSION GAS. *(Feroaroi seizoyo kaihogata denkiro haien no reikyaku hoho). Text in Japanese. (Nitto Boseki K. K. (Japan)) Japan. Pat. Sho 47-25561. 4p., July 12, 1972. (Appl. Nov. 19, 1970, 1 claim).*

Hot gases from a ferroalloy electric furnace are cooled by water sprayed from multiple sprayers located at the bottom of the stack. The action of the water sprays also accelerates dust aggregation and reduces the amount of flue gas. An automatic temperature control system connected to the water sprayers ensures that the amount of water sprayed is in accord with the flue gas temperature. Experimental results show that the effect on dust aggregation of this invention, with water sprayers at the bottom of the stack, is significantly higher than when water sprayers are located in the suction duct.

24689 **APTIC NO. 46384**

Schicht, Hans H.

FUNDAMENTALS AND APPLICATION OF CLEAN ROOM TECHNOLOGY. *(Grundlagen und Anwendung der Reinraumtechnik). Text in German. Gesundh. Ingr., 93(8):232-241, Aug. 1972. 35 refs.*

After a review of the properties of natural and artificial aerosols (60% of the natural continental aerosols are water soluble, 25 to 30% are organic substances developed at industrial processes), air filters for their removal from air for clean rooms are discussed. The aerosol concentration of the atmosphere varies greatly with time and place. While the air in rural areas contains 0.05 to 0.15 aerosols mg/cu m, urban areas measure 0.4 to 0.75 mg/cu m. During heavy smog in London as much as 4 mg aerosols have been measured. A prerequisite for clean rooms was the development of air filters which are capable of retaining the aerosols almost entirely. High efficiency particulate air filters should have a collection efficiency of at least 99.97% measured with a monodisperse dioctylphthalate (DOP) mist with a grain size of 0.3 micron. Nowadays filters with a DOP collection efficiency of 99.999% are available. Glass or asbestos fibers with diameters down to 0.1 micron are used. For high dust storage capacity and a low pressure loss, the individual fibers are arranged rather loosely. The air passes the filter medium with a velocity of 1 to 2 cm/sec. The use and operation of clean rooms is reviewed in greater detail.

24690 **APTIC NO. 46356**

Schwab, Georg-Maria and Ginter Donga

STUDIES ON EXTENDING THE ACTIVITY OF AN AFTER-BURNER CATALYST. *(Untersuchungen zur Ausweitung der Wirksamkeit eines Nachverbrennungskatalysators). Text in German. Chem.-Ing.-Tech., 44(16):957-962, 1972. 9 refs.*

The effect of n- and p-doping on the activity of afterburner catalysts for the purification of motor exhaust gases was studied for a silicic-acid supported copper oxide/manganese oxide catalyst containing alkali. Application of a measuring technique that considers the time dependence of the reaction permits precise assignment of the conversion and catalyst temperature for exothermic reactions too. Catalyst activity is lowered by p-doping with alkali but enhanced by n-doping with quadrivalent ions. Thorium in particular proves to be an extremely effective promotor. The temperature dependence of the conversion and the kinetic parameters can be determined. The results agree with the concepts of the relation between semiconductor and catalytic properties of metal oxides.

24691 **APTIC NO. 46164**

Schwarz, Richard C.

SUPERIOR FUEL OIL ADDITIVES CARRY GOOD ENGINEERING CREDENTIALS. *Natl. Engr., 76(8):5-7, Aug. 1972. 5 refs. (Presented at the National Association of Power Engineers, Industrial Oil Conference, Annual, 10th, Chicago, Ill., May 17, 1972.)*

The choice of a proper fuel oil additive for the particular problems that beset an individual boiler is a difficult task. Before making a choice, one should know what types of additives are available, what mechanism each uses to function, and possible environmental complications that can result from the use of each. The many additives on the market fall into four general groups: deposition control agents, combustion catalysts, sludge solubilizers, and water emulsifiers. Each of these functions is discussed. Various metal compounds in fuel oil additives include aluminum, barium, copper, lead, magnesium, and manganese. Points worth serious consideration in evaluating an additive supplier are listed. The condensation of sulfur trioxide can cause fouling of the heat recovery elements by a boiler system. Additives can reduce sulfur dioxide conversion to SO3. Combustion catalysts reduce carbon particulates such as ash in flue gas.

24692 **APTIC NO. 46116**

Scott, W. M.

DIESEL ENGINE DEVELOPMENT TO AVOID AIR POLLUTION. *Transport Eng. (London), 1972:6-8, April 1972.*

Operation and design modifications projected to meet the new standards for diesel engine-powered commercial vehicles governing noise, smoke, and vehicle performance issued by the Minister of Transport Industries are reviewed. The type of engine which will emerge will be a fairly highly turbocharged, long stroke, moderate speed direct injection engine. The design will incorporate structural modification to minimize noise radiation and it will also be fitted, where necessary, with close fitting noise shields or be enclosed in the vehicle to give minimum curb side and cab noise. Once the regulation limits have been met it will then be the responsibility of the operators to ensure that the engine is well maintained to avoid deterioration in either smoke or noise. Combustion chambers with controlled air-fuel mixing mechanisms and fuel distribution are discussed for control of black smoke emissions.

24693 **APTIC NO. 45744**

Semke, L. K.

AIR POLLUTION CONSIDERATIONS IN THE SELECTION OF NEW KRAFT RECOVERY BOILER SYSTEMS. *TAPPI, 55(8):1180-1184, Aug. 1972. 26 refs. (Presented at the Technical Association of the Pulp and Paper Industry, Annual Meeting, New York, Feb. 14-16, 1972.)*

For control of particulates and total reduced sulfur (TRS) from kraft recovery boiler flue gases, the proncipal approaches are based on electrostatic precipitation alone or in combination with black liquor oxidation. Both require that the recovery boiler not be fired substantially above design capacity. The combined approach allows the utilization of the direct contact evaporator for heat recovery from the flue gases and final concentration of the black liquor to firing solids content. The direct-contact evaporator also removes 25-50% of the particulates, thus reducing precipitator capacity requirements; 50-75% of the sulfur dioxide; and certain portions of the TRS. Availability of the oxidized heavy liquor permits the use of the relatively trouble-free wet-bottom design for the precipitator. Use of the precipitator alone requires alternate means for heat recovery, enlargement of the economizer or gas-to-air heat exchangers, and concentration of the black liquor by upward extension of the solids content range of the multi-effect evaporators. This approach, however, eliminates any contribution to TRS emissions due to direct contact between flue gases and black liquor, thus avoiding such problems as oxidizer malfunctions, reversion of oxidation during storage or evaporation, and stripping of TRS from the black liquor. For particulates from the dissolving tank vent gases, the principal control approaches are based on solid impingement, liquid impingement, and electrostatic precipitation; for TRS control from the evaporator noncondensibles, alkaline absorption and oxidative combustion are used. (Author abstract modified)

24694 **APTIC NO. 45688**

Sieu, Ho and Piotr Wasileswski

USE OF FOAM COLUMNS FOR ABSORPTION OF AMMONIA FROM COKE OVEN GAS IN AQUEOUS AMMONIUM DIHYDROGEN PHOSPHATE SOLUTIONS. *(Proba zastosowania kolumny pianowej do absorpcji amoniaku z gazu koksowniczego w wodnym roztworze fosforanu jednoamonowego). Text in Polish. Koks, Smola, Gaz, 17(3):76-81, 1972. 15 refs.*

Because of a much higher contact surface between the gas and the liquid, foam columns give much better results in ammonia absorption than the usual sieve-plate columns or columns with pneumatic mixing. The performance of an experimental column for ammonia absorption with an aqueous solution of ammonium dihydrogen phosphate solution is described. The column (1080 mm high) had three plates and was operated with foaming of the solution with an ammonia-air mixture. The effect of foam-layer thickness on the absorption coefficient and the absorption degree were determined. Very high values of the absorption coefficient and the absorption degree were obtained. At a gas-mixture velocity of 0.8 m/sec, the absorption coefficient was 10.4 kg/(cu m)(hr)(g/cu m), and the absorption degree was 93.4%. Increase in gas quantity leads to increase of flow rate, absorption coefficient, and absorption degree, and to a decrease of salt concentration in solution after completion of the absorption process.

24695 **APTIC NO. 45631**

Smorgunov, M. P., S. V. Sryvkov, and V. M. Ivannikov

IMPROVING THE EFFICIENCY OF ASH TRAPPING AND ASH REMOVAL DEVICES DURING EXPLOITATION OF KANSK-ACHINSK COALS. *(Povisheniye effektivnosti zoloulavlivaniya i gidrozoloudaleniya pri ispol zovaniix kansko-achinskikh ugley). Text in Russian. Energetik (Moscow), no. 6:8-10, 1972. 2 refs.*

Improvements in the efficiency of ash trapping and ash removal devices at thermal power plants using Kansk-Achinsk coals are described. Dry-type electrostatic precipitators with 98-99% efficiency had reduced efficiency for throughputs near the nominal load due to the high electric resistance of the ashes. New cyclones with tangential gas admission and sloped ash trapping elements have efficiencies of 93-95.5% even for such throughput, although the efficiency decreases with the load of the boilers. Such cyclones are reliable in operation due to reduced wear and the absence of clogging. As manual, hydraulic, chemical, mechanic, and thermal ash removal systems proved unsuccessful, a vibrational method combined with pressurized water flush under 10-12 atm has been adopted to remove carbonate buildups from ash discharge pipes.

24696 **APTIC NO. 45660**

Sonoda, Kiyoko

EXHAUST SYSTEM WITH DISINFECTION AND DEODORIZATION FUNCTIONS. *(Sakkin, dasshu kino o mo yusuru haiki sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 47-30505. 2p., Aug. 8, 1972. (Appl. Nov. 23, 1967, 1 claim).*

This device can be connected with the exhaust pipes of vacuum cars, sanitation trucks, garbage collection trucks, toilettes, factories, and sewage treatment plants for disinfection and deodorization purposes. It is made of a cylinder which is partitioned into three chambers by porous dispersion boards. In each chamber, a mesh inner cylinder is installed and the interval between the double walls is filled with a disinfectant chemical. Solid formalin may be used for this purpose. The lower end of the lowest chamber has a hole into which the exhaust pipe is inserted. The joint between the cylinder and the pipe is also partitioned with a porous board. Exhaust air from these facilities enter through the porous dispersion board and disperse in the lowest chamber, going through the mesh and passing through the disinfectant. The gas repeats dispersion through two other chambers before being discharged.

24697 **APTIC NO. 46257**

Spann, L. R.

FOUNDRY MODERNIZATION REDUCES ACCIDENTS OVER 60%. *Foundry, 100(9):50-53, Sept. 1972.*

As a result of a substantial modernization and facilities upgrading program, the Alloy Foundries Division of Eastern Company not only achieved a cleaner, more efficient, more mechanized and attractive work environment, but also reduced the frequency of accidents at its Naugatuck, Connecticut, malleable operation by more than 60%. The in-plant environment was improved with the installation of ceiling fans and a baghouse collection system. Stack emissions were improved, and overall solid waste disposal was solved to a great extent by the general upgrading of equipment and methods.

24698 **APTIC NO. 45740**

Stewart, J. F. and R. J. Diaz

USE OF SPENT STUMPWOOD IN LINERBOARD PRODUCTION. *TAPPI, 55(8):1212-1215, Aug. 1972. (Presented at the Technical Association of the Pulp and Paper Industry, Annual Meeting, 57th, New York, Feb. 14-16, 1972.)*

Spent yellow pine stumpwood was used as an economical source of wood fiber. It substitutes for 100,000 acres of pine forest annually. The air pollution problem caused by burning the spent stumpwood has been eliminated by using it in linerboard production. Laboratory and mill trials established the feasibility of producing quality linerboard from stumpwood. Normal pulp and paper manufacturing equipment was used. The mill trial provided design criteria for the washing system needed to remove excess sand from the stumpwood. The process is described in detail, and operational problems are discussed.

24699 **APTIC NO. 46125**

Sugimoto, Nobumichi

IMPROVEMENTS ON HEAT MANAGEMENT AT SAGANOSEKI REFINERY. *(Saganoseki seinensho ni okeru netsukanri no kaizen ni tsuite). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(6):14-21, June 1972.*

The utilization of waste heat and total heat management of refining facilities for copper and nickel are reviewed. The higher the hot air temperature for the flash smelting furnace, the smaller was the amount of heavy oil needed and the amount of flue gas discharged; however, sulfur dioxide concentrations increased. More than 99% of the sulfur content in ores was recovered as sulfuric acid and sodium sulfite. Measurements of SO2 concentrations at 16 areas in the factory vicinity determined that the average hourly concentration was about 0.02 ppm, much lower than the national standard of 0.05 ppm. The control of particulates was successfully accomplished using electric dust collectors and washing towers and by proper management of raw material storage.

24700 **APTIC NO. 45358**

Tanaka, Eiichi

A SURVEY OF DUST CONTROL AT IRONWORKS. *(Tekko puranto ni okeru hatsujin boshi no gaiyo). Text in*

Japanese. Kagaku Kogaku (Chem. Eng.), 36(8):815-821, Aug. 1972.

Techniques for dust collection at ironworks are reviewed. Dusts from coke furnace are controlled by spraying steam, high pressure ammonia water, or water to the vent, inducing a pressure decrease in the furnace. Hoods with proper suction power are usually used to collect dusts generated while mineral materials are being crushed. New regulations require the dust content of sintering furnace emissions to be less than 0.1 g/N cu m. The electrostatic precipitator is most commonly used for dust collection. Venturi scrubbers were also tested, but without satisfactory results. Dust collection in the vicinity of sintering furnaces and blast furnaces is also discussed.

24701 **APTIC NO. 45395**

Taniguchi, Kazuaki

TREATMENT METHOD FOR PETROLEUM FUEL COMBUSTION DUSTS. *(Sekiyukei nenryo no nensho baijin no shori hoho). Text in Japanese. (Kanden Fly Ash Co., Ltd. (Japan)) Japan. Pat. Sho 47-32504. 4p., Aug. 19, 1972. (Appl. April 8, 1970, 1 claim).*

This device relates to the treatment of petroleum fuel combustion dusts such as vanadium and ammonium compounds. Dust which contains ammonium sulfate is mixed with lime or carbide residue, or any other material which has the same effect, at a quantity of 1.5 to 1.6 equivalent to the amount of ammonia as (NH4)2SO4. The mixture is heated after water is added, and the ammonia gas evolved is recovered. The residues from this process are used as hydraulic materials or burned at about 700 C to recover the vanadium compound which can be used for vanadium production. Dust which does not contain ammonium sulfate is burned alone or with the residues of the above process at the same temperature for the recovery of the vanadium compound.

24702 **APTIC NO. 46126**

Taniguchi, Makio, Yasuo Imai, Katsu Hirai, and Ryu Yoshikawa

POLLUTIONLESS NITRIZATION METHOD NI-TEMPER PROCESS. *(Mukogai chikkaho naitenpa purosesu). Text in Japanese. Chutanzo (Casting Forging), 1972:75-83, March 1972. 7 refs.*

In 1970 a new nitrization method, the Ni-Temper process, was developed in which heat treatment is done to ammonia gas and the absorbing heat reaction gas, under the transformation temperature of copper. Once ammonia gas is heated on the surface of iron steel, it decomposes by an iron catalyst and nitrogen is absorbed on the surface of the steel and diffuses inside to create a compound layer. Compound layers of nitrogen have five layers as the reaction goes on. The chemical compound layer has a 2-2.5 micron thickness. The Ni-Temper process product is 5-10% superior to the salt bath process in hardness of the surface and is resistant to wear. As in the metal system, at the chemical layer and diffusion layer it is dense and homogeneous. The metal system by Ni-Temper process and the salt bath process are compared and shown in photographs. They show clearly that the Ni-Temper process makes more dense and more homogeneous surface chemical components than the salt bath process. The hardness of S 45 C material of diffusion layers, the bend fatigue resistance, rotating bend fatigue resistance, nature of plastic deformation in crankshaft, and wear of gear wheel were compared by Ni-Temper process and other processes and it indicates the Ni-temper process are superior. The most important characteristic of Ni-Temper is rust resistance. The Ni-Temper process can cost less than gilding, and it is more practical and effective.

24703 **APTIC NO. 45643**

Tarat, E. Ya., Yu. L. Ponomarev, and B. V. Antropov

SULFUR DIOXIDE ABSORPTION KINETICS IN ALKALINE SOLUTIONS UNDER FOAMING CONDITIONS. *(Kinetika absorptsii dvuokisi sera sodovymi rastvorami pri pennom rezhime). Text in Russian. Zh. Prikl. Khim., 45(5):1016-1022, May 1972. 15 refs.*

The influence of physical, chemical, and hydrodynamic factors on the sulfur dioxide absorption kinetics in sodium carbonate and sodium sulfite solutions under foaming conditions was studied in laboratory experiments. Departures from the linear dependence between absorption rate and SO2 partial pressure were due to the build-up over the absorbent solution of SO2 pressure which was in equilibrium with the concentration of SO2 molecules not engaged in the reaction. The absorption efficiency was independent of the SO2 partial pressure, when the rate of absorption was directly proportional to the latter, and decreased with reduced relative absorption rate at increased SO2 partial pressure. The absorption rate coefficients determined for gas flow rates of 1-2.5 m/sec, liquid flow rates of 0.625-3.5 cu m/m-hr and foam thickness of 120-190 mm ranged from 150,000 to 190,000 kg/cu m-hr-atm. The SO2 absorption coefficients were much higher for foaming than for other techniques. The SO2 absorption rate for sodium sulfite solution was practically the same as for sodium carbonate in equivalent concentration.

24704 **APTIC NO. 45757**

Teller, Aaron J.

CONTROL OF EMISSIONS FROM GLASS MANUFACTURE. *Ceram. Bull., 51(8):637-640, Aug. 1972. 5 refs. (Presented at the American Ceramic Society, Ceramic-Metal Systems Division, Fall Meeting, St. Louis, Mo., Sept. 13, 1971, Paper 3-C-71F.)*

Emissions from glass furnaces, ranging from noxious gases to submicron particulates, are unique in that they consist to a high degree of raw materials or degraded raw materials. Typical emissions from glass furnaces include particulates containing sodium fluoride, calcium fluoride, silica, calcium oxides, lead oxides, sodium sulfate, and boron oxides and gases of fluorides, nitrogen oxides, and sulfur oxides. Two systems were tested as prototypes for the control of emissions and to establish the potential for the recycle of the recovered contaminants. The wet system comprises a quench section, nucleation scrubber, and a water system consisting of a reactor-precipitator, solids separator, and cooling tower. The dry recovery system is based on simultaneous filtration and chromatographic absorption with pipeline solids injection and baghouse recovery. Both systems are characterized by low energy consumption and control emissions of particulates to the range of 0.01-0.03 grain/scf and noxious gases to the range of 1 ppm. System design, operation, efficiency, operating variables, and capital and operating costs are examined.

24705 **APTIC NO. 45759**

Tieman, John W.

CONTROLLING SO2 EMISSIONS FROM COAL-BURNING BOILERS: A STATUS REPORT. *Mining Engineering, 24(8):47-55, Aug. 1972.*

Various techniques to control sulfur dioxide emissions from coal-fired boilers for electric power production are reviewed with respect to principles and procedures of operation, state of technological development, and efficiency. Several methods proposed to control sulfur oxides include the use of alternate fuels; use of low sulfur coal; coal desulfurization; removal of SOx from flue gases; use of tall stacks; and use of new energy conversion principles. The most promising SO2 removal processes are dry additive injection, chemical processes, and sorption on solid reagents. Limestone slurry scrubbing, venturi scrubbers, by-product recovery, catalytic oxidation, absorption, alkalized alumina, and adsorption as bases for several commercial SO2 control and recovery methods are reviewed. New energy conversion processes to convert coal heat into electricity, including solvent refined coal, gasification, magnetohydrodynamics, fluidized bed combustion, and fuel cells are also discussed.

24706 **APTIC NO. 45434**

Tobiko, Torao

ELECTROSTATIC PRECIPITATOR. *(Denki shujin sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 47-25610. 2p., July 12, 1972. (Appl. Sept. 11, 1969, 1 claim).*

This invention relates to the removal of impurities in insulating fluid. Two or more dust-collecting plates made of porous or fiber materials are fixed at equal distances between the cathode and anode of the electrostatic precipitator with insulating fluid holders. When the holders are full and high voltage electricity is passed through the electrodes, dusts and impurities in the fluid are adsorbed by the plates. The apparatus is mainly for the purification of lubricant oil.

24707 **APTIC NO. 45677**

Trenkler, Herbert

TWENTY YEARS OF APPLICATION OF THE LD-PROCESS. *(20 Jahre LD-Verfahren). Text in German. Stahl Eisen (Duesseldorf), 92(15):709-716, July 1972.*

Despite the metallurgical and economical advantages of the LD-process, its rapid spread all over the world would not have been feasible had not the dust cleaning problem of the waste gases found an early solution. The experiments for dust cleaning of the waste gases were begun during the development of the process. A full success was achieved, however, only after the first two LD steel plants were taken into operation. The following dust collection methods proved to be suitable: wet scrubbers, venturi scrubbers, wet collectors operating on the multi-venturi system, wet or dry electrostatic precipitators, and bag filters. With every type of dust collector, the waste gases must be cooled after they leave the crucible. If the heat is used, a boiler system of various design is installed in the stack. For drawing off the waste air the crucibles are nowadays entirely enclosed to avoid infiltration of air.

24708 **APTIC NO. 45659**

Tsuji, Fumiko

EVEN TREATMENT OF WATER OR AIR BY A CHEMICAL TREATMENT. *(Mizu matawa kuki nado no ryutai o shori yakuzai de shori suru sochi). Text in Japanese. (Assignee not given.). Japan. Pat. Sho 47-30508. 3p., Aug. 8, 1972. (Appl. April 7, 1967, 1 claim).*

The device is designed to treat a flowing body such as water or gas with a disinfectant, desalting, ozone, or deodorizing agent, effectively and evenly even when the treatment chemical dissolves and decreases its volume. In the middle of the treatment pipe, a conical compartment or tapered square chamber is installed, and a solid block of a treatment chemical is installed in it. The chemical block has a hole of the same diameter as the pipe in the middle. The upper and lower parts of the pipe are fitted together like a box at this compartment. The thickness of the chemical is largest at the top and tapers off at the bottom. As the gas or liquid goes through this disinfectant or deodorant agent, the chemical gradually dissolves and the diameter of the hole enlarges. Then the speed of the flow decreases and the contact of the flowing body and the chemical is prolonged. However, since the shape of the treatment agent is conical or a tapered square block, its length alongside the pipe decreases with the increase of the diameter. Therefore, the decrease of the flow rate is made up for by the shortening of the length of the treatment chemical, and the same and steady amount of gas or liquid will be treated at all times.

24709 **APTIC NO. 45413**

Tsuzuki, Tomio

ELECTROSTATIC PRECIPITATOR FOR HIGH PRESSURE GAS. *(Koatsu gasuyo denki shujinki). Text in Japanese. (New Japan Ironworks) Japan. Pat. Sho 47-26823. 5p., July 19, 1972. (Appl. May 29, 1967, 1 claim).*

This invention relates to improvements in an electrostatic precipitator for high-pressure gas. The upper part of the dust collection chamber, which is the main body of the electrostatic precipitator, extends into a case-type cover with a flat top, and the entire dust collection chamber is raised. As a result, the nozzle tubes are shortened and the apparatus becomes compact.

24710 **APTIC NO. 46265**

Turner, David W., Robert L. Andrews, and Charles W. Siegmund

INFLUENCE OF COMBUSTION MODIFICATION AND FUEL NITROGEN CONTENT ON NITROGEN OXIDES EMISSIONS FROM FUEL OIL COMBUSTION. *Combustion, 44(2):21-30, Aug. 1972. 11 refs. (Presented at the American Institute of Chemical Engineers, 1972.)*

With regard to the control of nitrogen oxides from stationary sources, an investigation was conducted to determine the extent of fuel nitrogen conversion and the degree of control possible with combustion modification. Experiments with distillate and residual fuels indicated that 40-80% of the fuel nitrogen, depending on concentration, is converted to nitrogen oxide during combustion under normal operating conditions. This accounts for 100-200 ppm nitrogen oxide at normal residual fuel nitrogen contents of 0.1-0.4% and less than 30 ppm with normal distillate fuels. Flue gas recycle was very effective in reducing nitrogen oxide due to thermal fixation but it had little or no effect on fuel nitrogen conversion. However, simulated two-stage combustion indicates that this technique has excellent potential for reducing both fuel nitrogen oxide and thermal nitrogen oxide to very low levels. (Author abstract modified)

24711 **APTIC NO. 45347**

Uratochi, Suekichi and Kinji Hayashi

DEODORIZATION DEVICE FOR CHICKEN EXCRETA DRYER. *(Keifun kansoki ni okeru dasshuki). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 47-30829. 2p., Aug. 10, 1972. (Appl. March 29, 1968, 1 claim).*

The odor containing exhaust from the chicken excreta dryer is led into the system through the pipe and enters a scrubber, where the water in the tank is constantly splashed by the guiding feathers attached to a rotating axis. The gas then rises and goes through the filtering material (sponge or other suitable material) in the upper chamber. There is a nozzle at the top of the upper chamber, which sprays water into this chamber. The gas is led then by a ventilating fan to a pipe and a combustion chamber, where an oil burner is installed. The combustion chamber is made of double pipes and the gas cannot excape from the stack unless it is burned first. Thus, deodorization is achieved by scrubbing, filtering, and combustion.

24712 **APTIC NO. 46060**

Vick, Erhard

CLEAN AIR IS NOT DULL THEORY. A COMMUNICATION ON WASTE GAS CLEANING EQUIPMENT. *(Reine Luft ist keine graue Theorie. Ein Erfahrungsbericht ueber Abluftreinigungsanlagen). Text in German. Ind. Lackier Betr., no. 4, 1972.*

Various direct burning equipment designed for waste gas cleaning in lacquering shops is described. The waste gases contain vapors or aerosols of combustible organic substances. Drying furnace waste gases of 200 and 120 C temperature are incinerated in a temperature range of 650-750 C in a coil coating plant. The carbon content is reduced from 1500 to 30 mg/N cu m, corresponding to an efficiency of 98-99.5%. The phenol and formaldehyde vapors present in waste gases of 200-300 C temperature in a mineral fiber processing plant are burned at a reaction temperature of 770 C. The hot cleaned air is used to preheat the fresh air for the drying furnace. Automatic cleaning equipment treats the waste gases from the drying furnace of an auto parts lacquering shop at 600-850 C with an efficiency of 99.5%. The waste gases from another lacquering shop drying furnace are burned at 800 C, with efficiency at 98% (carbon content reduced from 4000 to 80 mg/N cu m). Economic calculations for different reaction temperatures and throughput capacities are presented.

24713 **APTIC NO. 45710**

Wagner, A. J.

MONITORING OPERATION OF A MULTIPLE-COLLECTOR POLLUTION CONTROL INSTALLATION. *Mod. Casting, 62(2):36-37, Aug. 1972.*

An electronic monitoring system was installed at a metal casting facility to ensure efficient operation of the venturi scrubbers and baghouses used for dust collecting and emission control. The console installation is compact and automatic. The monitor is equipped with its own communication system. Some of the foundry operating conditions, monitoring system instrumentation and operation, and plant control facilities are reviewed.

24714 **APTIC NO. 46138**

Waid, Donald E.

THE SWEET SMELL OF SUCCESS IN POLLUTION ABATEMENT PROGRAMS. *Ind. Gas, 52(7):14-17, July 1972.*

Many industrial processes produce little that would offend the olfactory sense, but where odors are present, the most practical solution often is thermal incineration, utilizing a direct natural gas flame. This process is very effective in controlling certain air pollutants but should be restricted to those applications where it is desired to oxidize gaseous and fine particulate hydrocarbons to carbon dioxide and water vapor. Some of the most common odor producing processes and types of equipment that can be controlled with direct gas flame incineration are coffee roasters, core ovens, fat rendering, meat smokehouses, metal coating ovens, packing house effluents, paint baking ovens, varnish burn-off, varnish kettles, and wire enameling. Catalytic and flame incineration are described, as well as adsorption, wet scrubbing, and thermal incineration. Development of direct gas-fired thermal incineration is discussed, and design criteria are considered. Effluent velocity, pressure drop, amount of profile plate opening around the burner, combustion chamber considerations, and temperatures are mentioned as significant design parameters. Special considerations for odor control are included, and utilization of the heat produced is discussed. Advantages of the thermal process are cited.

24715 **APTIC NO. 45763**

Walther, James E. and Herman R. Amberg

EMISSION CONTROL AT THE KRAFT RECOVERY FURNACE. *TAPPI, 55(8):1185-1188, Aug. 1972. 9 refs. (Presented at the Technical Association of the Pulp and Paper Industry, Annual Meeting, New York, Feb. 14-16, 1972.)*

Total reduced sulfur and sulfur dioxide emissions from a conventional kraft recovery furnace using a cyclone-type direct contact evaporator were compared with emissions from a low odor recovery furnace using an air contact evaporator designed to eliminate contact of the flue gas with black liquor. The system, exclusive of the off-gas from the black liquor oxidizer, could be operated at total reduced sulfur levels comparable to the new low odor units if the black liquor feed to the cyclone evaporator were oxidized to a sodium sulfide concentration of 0.3 g/l or less. However, when the emissions from high efficiency black liquor oxidation are taken into consideration, a twofold increase in total reduced sulfur emission can be expected in comparing the conventional with the new systems. The direct contact evaporator removed about 20-30% of the dust and 75% of the SO2; during furnace upsets, removed significant quantities of total reduced sulfur providing the black liquor has a pH of 12 and was completely oxidized; and permitted greater flexibility in operation of the conventional recovery furnace complex without exceeding total reduced sulfur and SO2 emissions. (Author abstract modified)

24716 **APTIC NO. 45625**

Watahiki, Kanau

FILTERING DEVICE. *(Firuta sochi). Text in Japanese. (Hitachi Manufacturing Co. (Japan)) Japan. Pat. Sho 47-34545. 3p., Aug. 31, 1972. (Appl. Dec. 29, 1969. 1 claim).*

This invention relates to a filter for treating flue gas from an atomic power plant containing harmful radioactive substances. An operating pivot and a hook are extended to the filter from a car running on rails above the filter container at a certain height. The pivot is operated by a handle-bar and the hook is operated by crane. Replacement of the filter in the filter container is performed by the combined actions of a clamping bolt, a box spanner, and a spring stopper through the operation of the handle-bar and the crane. The device provides a safe way of replacing a filter from a distance.

24717 **APTIC NO. 46118**

Wood, Lowell, and John Nuckolls

FUSION POWER. *Environment, 14(4):29-33, May 1972. (Presented at the American Association for the Advancement of Science Symposium, Dec. 29, 1971.)*

The intense Soviet-American competition in the fusion microexplosion field may be expected to produce a breakeven level experiment in the next 24 mo and net energy producing systems may be confidently foreseen. Such approaches range in degrees of unconventionality from magnetically confined laser-heated plasmas to laser-initiated fusion microexplosions. Conventional research is still a considerable distance from producing more fusion than electrical energy consumed. Research is underway on attempts at controlling thermonuclear plasma with resonantly applied, extremely high-intensity microwave radiation. A power producing configuration of this type would be able to run steady state. Definite results regarding feasibility are expected in a very few years. Magnetically confined laser-heated plasmas are seen as another possibility. For sufficiently energetic multimegajoule lasers and sufficiently long magnetic mirror configurations, calculations of a reliable nature indicate that net electrical energy would be producible. Soviet workers are making progress in preheating fusion fuel and compressing it adiabatically to efficient burn conditions. The most promising proposal uses high power laser compression of deuterium-tritium fuel to star temperatures producing an efficient thermonuclear microexplosion. This scheme makes commercial fusion power plants feasible with practical size lasers such as will probably be constructed within a few years. These examples are offered in general support of the assertion that the oldest controlled thermonuclear reactor approaches are not necessarily those that will quickly lead to breakeven levels of fusion energy production. Newer approaches constitute justifiably strong competion.

24718 **APTIC NO. 45433**

Yadera, Isamu

ELECTROSTATIC PRECIPITATOR. *(Denki shujinki). Text in Japanese. (Matsushita Seiko Co., Ltd. (Japan)) Japan. Pat. Sho 47-26824. 3p., July 19, 1972. (Appl. June 8, 1967, 1 claim).*

This invention relates to an electrostatic precipitator with high safety at time of cleaning of the dust collection chamber. A plug with a blade at one end is attached to a cover plate at the other end. The plug is inserted into the swan socket of the switch case and the blade contacts a connecting piece so that current flows into the dust collection chamber. Meanwhile, a level bar with a conductive metal piece at the end is disconnected from the earth of the dust collection chamber. At cleaning time, the plug is removed and the current flow is stopped due to the detachment of the blade and the connecting piece. The lever bar returns to its original position so that the conductive piece contacts the earth of the dust collection chamber and the current residue is released.

24719 **APTIC NO. 45399**

Yamasaki, Shigeru

VENTURI-TYPE DUST COLLECTOR. *(Benchuri-gata shujin sochi). Text in Japanese. (Yokoyama Engineering Co., Ltd., Tokyo (Japan)) Japan. Pat. Sho 47-32097. 2p., Aug. 17, 1972. (Appl. April 6, 1969, 2 claims).*

Two venturi dust collectors with variable cross-section areas in the throat are described. In the first collector, two pieces of hollow metal are placed symmetrically in the throat, each with one end attached to the wall of the venturi and the other to a spray nozzle from which washing solutions are sprayed in the desired direction. In the second collector, one piece of hollow metal with spray nozzles at both ends is attached at its center to the throat of a venturi. The metal can be rotated to direct the washing solutions in the desired direction. With the above arrangements, a washing solution can be thoroughly dispersed in gases to be purified.

24720 **APTIC NO. 45673**

Yamasaki, Shigeru and Masumi Nishikawa

RECOVERY OF INCOMPLETE COMBUSTION GAS FROM A CONVERTER. *(Tenro no minensho gasu kaishu hoho). Text in Japanese. (Yokoyama Engineering Co., Ltd. Tokyo (Japan) and New Japan Ironworks) Japan. Pat. Sho 47-25962. 3p., July 14, 1972. (Appl. June 30, 1967, 1 claim).*

This invention relates to the recovery and dispersion of combustible gas from a converter. A gas recovery apparatus and gas dispersion stack are connected to the converter through an air pump and a dust collector. Two hydraulic seal valves and two dispersion valves are located in the ducts leading to the recovery apparatus and dispersion stack, respectively. A bypath tube with a valve is also located in the stack. By the alternate opening and closing of the valves, the recovery and dispersion of the combustible gas can be controlled safely and effectively as desired.

24721 **APTIC NO. 45738**

Young, Harold E.

PUCKERBRUSH UTILIZATION FOR PAPER PRODUCTS. *TAPPI, 55(8):1202-1204, Aug. 1972. 19 refs. (Presented at the Technical Association of the Pulp and Paper Industry, Annual Meeting, 57th, New York, Feb. 14-16, 1972.)*

Management and utilization of forests are practiced within the framework of the Merchantable Bole Concept. However, this concept does not provide for the woody fiber requirements or or the stability of the forests for air, water, and recreation. Biomass, nutrient, and pulping studies led to the Complete Tree Concept in 1964, and this evolved into the Complete Forest Concept in 1967. The implications of these concepts are discussed and contrasted with the Merchantable Bole Concept. Since 1969 these concepts have been extended to the Concept of Production and Utilization of the noncommercial tree and shrub species which are commonly called puckerbrush in Maine. The availability, growth, potential growth, and pulping characteristics of these species for paper products are summarized. This alternative source of woody fiber can reduce pollution by utilizing material now burned or sprayed with chemicals and thus reduce the pressure on dwindling forest acres. (Author abstract modified)

24722 **APTIC NO. 45453**

(Inventor not given.)

REMOVAL AND RECOVERY OF SULFUR OXIDES FROM GASES. *(Westvaco Corp., New York) Brit. Pat. 1,257,096. 10p., Dec. 15, 1971. 4 refs. (Appl. July 28, 1969, 19 claims).*

Sulfur dioxide and trioxide can be removed from flue gases by adsorbing the oxides onto activated carbon, while the spent carbon can be regenerated by contacting it first with an oxide-reducing gas such as hydrogen sulfide and subsequently contacting it with a sulfur-reducing gas. Advantages offered by this process include the ability to use a carbon possessing superior adsorption rate and capacity characteristics. Burn-off of activated carbon may be virtually eliminated, and the sulfur oxide removal may be performed at flue gas temperatures. Regeneration by chemical reduction has the further advantage of producing a stream concentrated in SO2 which can be further processed to such products as liquid SO2, sulfuric acid, or sulfur. The invention may be carried out in either a fixed bed or a continuous manner.

24723 **APTIC NO. 45475**

Archer, D. H., D. L. Keairns, J. R. Hamm, R. A. Newby, W. C. Yang, L. M. Handman, and L. Elikan

EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT. *Westinghouse Research Labs., Pittsburgh, Pa., Office of Air Programs Contract CPA 70-9, APTD-1165, 188p., Nov. 1971. 16 refs.*

NTIS: PB 211494

The effectiveness and economics of fluidized bed combustion boilers in pollution abatement and steam/power generation were evaluated. A 250,000 lb/hr coal-fired industrial boiler was designed along with all its auxiliaries. Utility boilers were also designed for operation at atmospheric pressure in conventional steam power plants and for operation at 10 atm in a combined steam and gas turbine power plant. Overall capital and operating costs were estimated for both 300 and 600 megawatt plants. The pressurized fluidized bed combustion boiler operating in a combined cycle power plant was most effective in meeting projected emission standards and in reducing total sulfur dioxide, nitrogen oxide, and particulate emissions, and most economical in power generation. The plant has an estimated captial cost 20% less and energy cost 10% less than a conventional utility plant with a stack gas scrubber. A fluidized bed oil gasification-desulfurization system was also designed and evaluated as an add-on unit for reducing SO2 emissions from utility boilers burning high-sulfur oils. The estimated capital cost of the unit was as much as 50% less than an add-on wet scrubbing system. Complete data on design and concepts of the system, preliminary surveys, fluidized bed combustion application, and economics are included. (Author abstract modified)

24724 **APTIC NO. 45539**

Baudelaire, Jean

ACTION IN THE LIME AND CEMENT INDUSTRIES. *(Action dans l industrie des chaux et ciments). Text in French. Pollut. Atmos. (Paris), vol. 13:40-43, May 1971.*

Problems of air pollution and control measures within the lime and cement industries are outlined. Dust emissions from cement works are harmless to animals and plants; a certain fertilizing effect was observed in soils. Most of the sulfur dioxide formed from combustion is bound by the product itself. No silicosis in workers in cement works has yet been observed. Dust emissions are controlled by means of tissue filters, cyclones, and electrostatic dust separators. The use of glass-fiber filters is under study. Airtight, automated clinker storage facilities are required. Losses due to dust emissions from cement works account for some 0.5% of the total production. A maximum allowable dust concentration of 150 mg/N cu is required, with a limit of 1 g/N cu m. Costs of control equipment are considered.

24725 **APTIC NO. 45426**

Belonozhko, A. M.

COKE AND CHEMICAL PRODUCTION WASTES AND WAYS OF USING THEM. *Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), no. 9:48-50, Sept. 1971. 8 refs.*

Wastes from coke and chemical plants are a serious loss which can damage the national economy and cause problems of air, water, and soil pollution. Solid wastes include clinker, dirt, flotation tailings, lime sludge, and coal waste. The existing dumps are approaching saturation. More use must be made of clinker for road building; coal wastes can be gasified; coal sludge can be incorporated into carbonization charges; and alternatives can be used instead of lime. Recommendations are presented for producing useful chemicals from still bottoms and solar oil. Further work is required on uses for sulfuric acid and alkaline wastes which are regularly dumped by chemical works. Waste chemicals from arsenic-soda sulfur removal plants, vacuum-carbonate sulfur removal plants, and wastes in the form of ammonium sulfate solution and tar liquor are presently being utilized in the production of industrial chemicals.

24726 **APTIC NO. 45532**

Boubel, Richard W. and David C. Junge

A STUDY OF FLUIDIZED BED FILTERS SUBJECTED TO HIGH RADIAL ACCELERATIONS. *Preprint, American Inst. of Chemical Engineers, New York, 16p., 1971. 5 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 64th, San Francisco, Calif., Nov. 28-Dec. 2, 1971.)*

Rotating fluidized beds were used to investigate the effects of radial acceleration on fluidized beds used for filtration of airborne particulate of submicron size. Glass spheres with a mean diameter of 15 micron were used as the bed material and sodium chloride aerosols were used as the particulate matter. Level of radial acceleration was varied from 44 to 417 G. Other independent variables included volumetric flow rate of gas through the bed and shape of the bed retainer. The dependent variable was filtration efficiency. Test results indicate that the level of radial acceleration, the volumetric flow rate of gas through the bed, and the shape of the bed retainer all have a statistically significant effect on filtration efficiency at the 5% level of significance. Efficiency is related to the independent variables in a mathematical model. (Author abstract)

24727 **APTIC NO. 45544**

Descolas, Jean

THE ACTION TAKEN BY DUST SEPARATORS MANUFACTURERS. *(Action des constructeurs de separateurs et epurateurs). Text in French. Pollut. Atmos. (Paris), vol. 13:48-49, May 1971.*

Developments in dust separating techniques and dust separator production in France are reviewed. Economic and reliability factors should be considered when choosing between optional dust separating techniques. Dry dust collectors, venturi scrubbers for blast furnaces, bag filters, electrostatic precipitators, and gas scrubbers underwent spectacular development during the past years. Glass-fiber bag filters are able to treat gases with a maximum temperature of 315 C, with dust removal from bag filters by knocking and air counter-flow. Discharge electrodes with increased strength, electronic controls, and silicon rectifiers have been developed for electrostatic precipitators. Scrubbers are used for the removal of sulfur dioxide, fluorine, and odorous gases in the aluminum, pulp, and chemical industries. The market of dust separators projects a yearly growth of 15-20% in the near future. Exports accounted for some 20% of the total sales. The respective shares of dry cyclones, wet type dust separators, electrostatic precipitators, and bag filters are 15, 20, 35, and 25%, respectively.

24728 **APTIC NO. 45618**

Gillespie, G. R., A. A. Boyum, and M. F. Collins

CATALYTIC PURIFICATION OF NITRIC ACID TAIL GAS: A NEW APPROACH. *Preprint, American Inst. of Chemical Engineers, New York, 20p., 1971. 5 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 64th, San Francisco, Calif., Dec. 2, 1971.)*

Control methods for effluents from a typical nitric acid plant are examined with respect to process operations, federal emission standards, and a modified process of tail gas purification. Decolorization or abatement operations usually consist of palladium or platinum catalysts, with methane used as a fuel source; tail gas reactors are often included in the standard designs. The catalytic combustor for simple power recovery or decolorization, however, is no longer sufficient. Problems in combustor operation included poor mixing, excessive fuel-oxygen ratio, reaction rate limitations, thermal limitations, and catalyst poisons. The modified control system to meet federal standards embodies a single stage abater, abater bypass for start-up and shut-down, a spherical palladium catalyst, and fuel desulfurization, with incorporated controls for inlet temperature, fuel-oxygen ratio, and temperature protection of catalyst and turbine. The design and operation of the modified system and some future trends in abatement technology are examined.

24729 **APTIC NO. 45577**

Hellemans, J. and M. W. Lensvelt

THE CONTRIBUTION OF INDUSTRY TO ENVIRONMENTAL POLLUTION CONTROL. *(Industriele bijdragen tot bestrijding van het milieubederf). Text in Dutch. Polytech. Tijdschr., Ed. A, 26(9):327-333, 1971. 2 refs.*

The importance of the coordinated action of different industries in environmental pollution control and general problems of air pollution are discussed along with available pollution control techniques. Solid pollutants can be retained by means of precipitators; cyclones, multicyclones, scrubbers, tissue, paper, or fiber filters, and dry or wet-type electrostatic filters. Scrubbers, cyclones, gas filters, and electrostatic precipitators can be used for liquid pollutants, while vapors and gases can be controlled by scrubbing, neutralization, absorption, adsorption, and catalytic or thermal incineration. Odorous substances can be eliminated by scrubbing with water or other liquids, masking with odor odors, or by thermal or catalytic afterburning. Gaseous and odorous emissions can also be discharged through high stacks to provide good dispersion. Efficiencies, pressure losses, and capital and operating costs of different type dry and wet dust collectors with the same capacity are given. The data show rapid increase of costs with increasing efficiency.

24730 **APTIC NO. 45376**

Khomutinnikov, P. S. and N. I. Shipulin

ELECTROSTATIC PRECIPITATION OF DUST IN OPEN-HEARTH FURNACES. *(Elektricheskaya ochistka ot pyli gazov Martenovskikh pechey). Text in Russian. Metallurg, 16(4):19-22, April 1971.*

Various electrostatic precipitators used for open-hearth furnaces are reviewed. When oxygen is injected into the fuel spray only, satisfactory results are obtained using two or three-pole electrostatic precipitators with horizontal gas flow. The dust content of the flue gas, its humidity, and the grain size distribution depend on the tonnage of the furnace, the heat engineering and technological melting conditions, and the intensity of the oxygen blast. One type of electrostatic precipitator can reduce the dust content to 50 mg/cu m when no oxygen blast is applied but requires increased humidity for stable operation during oxygen blast. The humidity content is increased to 130-150 g/cu m by means of steam from the evaporative cooler. A residual dust concentration of 150 mg/cu m, at a flow rate of 1.3 m/sec and a maximum gas temperature of 250 C, was reduced to 100 mg/cu m by decreasing the flow rate to 1.0 m/sec. A new electrostatic precipitator with C-shaped plate type precipitator electrodes and needle type discharge electrodes displayed high and stable efficiency during oxygen blast conditions; residual dust concentration with a humidity content of 70 g/cu m and a gas flow rate of 0.9 m/sec was 50 mg/cu m, with a maximum of 100 mg/cu m a flow rate of 1.3 m/sec.

24731 APTIC NO. 45478

Lasserre, P.

THE FIGHT AGAINST ATMOSPHERIC POLLUTION BY FURNACES. *(La lutte contre la pollution atmospherique par les foyers). Text in French. Nuisances Environ. (Paris), no. 1:47-50, Feb. 1971.*

Problems of combustion-generated air pollution and adequate preventive and control measures are reviewed. Depending on the specific fuel used, combustion processes generate such pollutants as ash, unburned hydrocarbons, soot, tar, water vapor, carbon monoxide, carbon dioxide, sulfur oxides, and nitrogen oxides. The use of fuels emitting minimum amounts of pollutants, such as coal with low ash, volatile, and sulfur contents, low-sulfur or desulfurized fuel oil, and natural gas, as well as additives such as magnesia or ammonia, and improvement of heating equipment are the most essential preventive measures against air pollution. Combustion-generated emissions can be effectively controlled by means of mechanic, hydraulic, and electric waste-gas treatment procedures. Cyclones usually have reduced efficiency for particles smaller than 10-50 micron; the efficiency of scrubbers, reaching values up to 99%, depends mainly on the physical and chemical properties of the gas treated. It is possible to clean waste gases with a maximum temperature of 280 C by means of bag filters made of synthetic fibers.

24732 APTIC NO. 45607

Lin, Yen Kuang

COMPRESSIBILITY, STRENGTHS AND FROST SUSCEPTIBILITY OF COMPACTED FLY ASH. *Michigan Univ., Ann Arbor, Dept. of Civil Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1971, 180p. 63 refs.*

A comprehensive study was made of the engineering properties of some typical Michigan fly ash. The ultimate objective of the study was to determine the suitability of fly ash as a construction material in load-bearing fills and subbases. Index properties, strength, frost susceptibility, and compressibility of compacted ash were investigated. Effects of material aging on the engineering properties of fly ash are emphasized throughout in recognition of the pozzolanic behavior of fly ashes containing small amounts of lime. The unconfined compressive strength of compacted, untreated Michigan fly ashes ranged from only 1.2 to 3.9 kg/sq cm when samples were compacted to maximum dry density. Moist curing and higher curing temperature did not improve their strengths. A substantial improvement in strength as a result of lime stabilization was observed. The addition of a few percent by weight of hydrated lime increased the compressive strength more than 10-fold after four weeks of moist curing. This strength is still slightly lower than the strength required for base courses beneath road pavements. The amount of additional lime required in fly ash to reach the highest strength varies from one ash to another. Higher curing temperature strengthened lime-treated fly ash. Five percent cement is sufficient to reduce reduce frost heave of Michigan fly ashes within tolerable limits. Primary consolidation is less significant than it would be in ordinary soils, hence the rate of settlement would tend to be independent of the thickness of the soil layer. The compressibility of partially saturated fly ash is lower than that in a fully saturated condition. To reduce the laboratory effort that is required to take into account the aging effect of fly ash, a creep function derived from viscoelastic theory can be used to predict the compressibility of fly ash at different stages of aging.

24733 APTIC NO. 45470

Lukas, Wolfgang and Josef Gloger

DETERMINING THE FRACTIONAL SEPARATING EFFICIENCY OF CENTRIFUGAL SEPARATORS AS A FUNCTION OF THE ORIGINAL DUST CONCENTRATION AND THE CYCLONE INLET FLOW RATE. *(Abhaengigkeit der Fraktionsabscheidegrade de Fliehkraftabscheider von der Rohgasstaubbeladung und der Zykloneintrittsgeschwindigkeit). Text in German. Chem. Tech. (Berlin), 23(12):724-727, Dec. 1971. 21 refs.*

The dependence of the fractional separating efficiency of the original dust concentration and the inlet flow rate was studied on an experimental cyclone with quartz powder as the test dust. Concentrations of 5, 25, and 50 g/cu m and inlet flow rates of 17.90, 16.85, 13.45, 10.01, and 6.74 m/sec were applied at throughputs of 530, 500, 400, 300, and 200 cu m/hr. The fractional separating efficiency for the different inlet flow rates was largely the same, and a tendency of increased overall efficiency with increased flow rate was observed. The fractional efficiency, increasing with the inlet flow rate, fell for particle sizes below 2.5 micron. The lowest fractional efficiency was observed for 25 g/cu m. The fractional efficiency curve obtained for the experimental cyclone was compared to curves obtained for other cyclones.

24734 APTIC NO. 45476

Marshall, W. F. and R. D. Fleming

DIESEL EMISSIONS AS RELATED TO ENGINE VARIABLES AND FUEL CHARACTERISTICS. *Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1971. 5 refs. (Presented at the Society of Automotive Engineers, National Combined Fuels and Lubricants, Powerplant and Truck Meetings, St. Louis, Mo., Oct. 26-29, 1971, Paper 710836.)*

The influences of fuel characteristics and engine parameters on exhaust emissions were studied experimentally using four diesel engines. All engines utilized direct-injection combustion systems and included a 2-cycle, air scavenger unit and three 4-cycle engines. Two of the 4-cycle engines were naturally aspirated, and one was turbocharged. Seven fuels were selected to cover the broad compositional ranges of diesel fuels marketed throughout the country. Aside from the effect of fuel density on carbon monoxide emission, no fuel property showed an influence on emissions that was consistent for all engines tested. The study of engine variables included modifications to the fuel injection system, variations in intake air temperature and density, exhaust recirculation, and water injection. As diesel engines generally emit large quantities of nitrogen oxides and little carbon monoxide or unburned hydrocarbons, the study was aimed primarily at reducing nitrogen oxide emissions while maintaining engine performance and an otherwise favorable emission pattern. Levels of emissions other than oxides of nitrogen are near minimum when the engine is adjusted for peak performance. Exhaust gas recirculation and addition of water to the intake air were quite effective in limiting emissions of oxides of nitrogen. (Author abstract modified)

24735 APTIC NO. 45584

McWilliams, James K. and Grayson Heard

DUST CONTROL AT OHIO VALLEY. *Preprint, American Mining Congress, Washington, D. C., 12p., 1971. (Presented at the American Mining Congress, Coal Convention, Pittsburgh, Pa., May 16-19, 1971.)*

The Ohio Valley Division of Consolidation Coal Company includes three mines in northern West Virginia which are designed to produce 9 million tons of coal annually. With the passage of the Federal Health and Safety Act of 1969, the Division began a sampling program to identify the worst dust conditions. The first action taken was an appraisal of the dust control techniques already available on the sections and how their efficiency could be improved. At that time the methods included suppression of dust using water or removing the airborne dust from the face area. Fans are also utilized in the mining areas. Educating people to believe in dust control is one of the most important steps in achieving a working dust control program.

24736 **APTIC NO. 45364**

Mitsch, G. L. and R. A. Wright

THE ELECTROSTATIC PRECIPITATOR AND THE CUPOLA – 1971. *Trans. Am. Foundrymens Soc., vol. 79:257-260, 1971. 3 refs.*

The selection, performance, operating variables, and costs of an electrostatic precipitator for an emission control system applied to a gray iron foundry cupola are reviewed. Scrubber, baghouse, and precipitator performance and efficiency data are compared. Complete capital, maintenance, and operating costs are documented and compared with those for other control devices. A test cupola at one foundry produces 12 t/hr on a 4-5 hour shift for 5 days/wk. The precipitator handles 35,000 cu ft/min at 500 F with a maximum inlet grain load of 3 g/cu ft/min; precipitator efficiency is 99.2%. Stack emissions are significantly lower than the maximum allowable emission standards. The annual additional operating cost of the system is $0.70/t of iron produced. (Author abstract modified)

24737 **APTIC NO. 45562**

Ryabov, A. V.

DESIGNING PNEUMATIC CONVEYING SYSTEMS FOR METAL SHAVINGS AND DUST. *(K raschetu sistem pnevmotransporta metallicheskoy struzhki i pyli). Text in Russian. Vestn. Mashinostr., 51(8):40-41, Aug. 1971. 3 refs.*

Problems of the design and calculation of pipelines for pneumatic shavings and dust conveying systems are described. The weight concentrations of metal shavings and dust in the air conveyed by such tubes ranges from 0.3 to 1.0 kg/kg. A simple formula for the calculation of the friction coefficient for given pipe wall surface roughness and air kinematic viscosity is given. A simplified formula of the pressure loss occurring in pipes carrying shavings and dust, with a maximum length of 10 m, is derived. The proportionality constants involved range from 0.85 to 1.22.

24738 **APTIC NO. 45477**

Svidrnoch, Ladislav

SINTER DUST REMOVAL BY DRY AND WET SEPARATORS. *(Zachycovani aglomeracnich prachu suchymi a mokrymi odlucovaci). Text in Czech. Hutnik (Prague), 21(1):1-4, 1971.*

All operations involving the production and processing of sinter require the use of dust control equipment. Particle size of the dust to be controlled varies from 5 to 50 micron, which lends itself to separation by cyclones and fabric filters. A cyclone type BMM Meizr, with 360 cells and a diameter of 300 mm with a 75 sq m suction surface working at 120-240 C, was found to process 410,000 cu m waste gas/hr with an efficiency between 80-90%. Wet separation by means of MVA-type scrubbers processing 21,500 cu m gas/hr with an efficiency of up to 97.8% was tried, but all attempts to use scrubbers with sinter dust-laden air failed because the functional parts were continuously clogged and required constant cleaning. Sinter dust contains from 10-27% calcium oxide, which causes carbonate hardening resembling the hardening of mortar. Carbon dioxide from the atmosphere reacts with CaO forming hard deposits to which the other inert components of the sinter adhere. Sulfuric acid had to be used to dissolve these deposits. It is also possible that the contact of sinter dust with water induced the hardening that occurs in cement, which is caused by the sole action of water on a suitable mixture of CO2, silica, alumina, and iron oxide.

24739 **APTIC NO. 45415**

Tutaeva, N. L. and V. S. Komarov

KINETICS OF BENZENE VAPOR ADSORPTION ON ZEOLITE CONTAINING ALUMINOSILICATE CRACKING CATALYSTS. *(Kinetika adsorbtsii parov benzola na tseolitsoderzhashchikh alyumosilikatnykh katalizatorakh krekinga). Text in Russian. Dokl. Akad. Nauk Beloruss. SSR, 15(9):806-809, 1971. 21 refs.*

The kinetics of benzene vapor adsorption from a nitrogen stream were studied on four different samples. The samples were: aluminosilicate I obtained after acid-base activation of kaolin; and I plus 10 and 20% of sodium halides by weight of the zeolite. An increase in the zeolite content of I decreased the effective diffusion coefficient. This was probably due to the increase in adsorption on the surface and its decrease inside the granules. The diffusion coefficient divided by the tortuosity coefficient of the pores (k) increased with increased zeolite in I.

24740 **APTIC NO. 45384**

Uhl, William C.

NEW QUEBEC REFINERY FEATURES MANY NEW IDEAS. *World Petrol., 42(12):28, 54, Dec. 1971.*

New or modified control methods and equipment installed by a refinery are reviewed. Air-cooled heat exchangers were substituted for water-oil exchangers to reduce the actual volume of process water effluents. All flue gases are routed to a 250-ft high exhaust stack for maximum and efficient dispersal into the atmosphere without affecting nearby communities. Oil contaminated wastewater is sent to a corrugated plate interceptor.

MEASUREMENT METHODS

1972

24741 **APTIC NO. 45405**

ON THE DETERMINATION OF CHLORINE IN AIR BY MEANS OF METHYL ORANGE. *(K opredeleniyu khlora s metilovym oranzhevym v atmosfernom vozdukhe). Text in Russian. Gigiena i Sanit., 37(16):97, 1972.*

An improved colorimetric method for the determination of chlorine in air by means of methyl orange is proposed. The methyl orange solution to be used for absorption is standardized after titrimetric test on the basis of its optic density which is measured by means of photoelectric colorimeter against water. The methyl orange solution with known optic density and a standard chlorine solution (10 micrograms/ml) are then used to obtain a calibration curve by means of photoelectric colorimeter at a wavelength of 540 nm. As the optic density of the methyl orange solution is adjusted each time without the use of titrimetric procedures, and as visual colorimetric determination is abandoned, a high-precision, simplified and rapid analytic method is obtained.

24742 **APTIC NO. 45435**

Yokagawa Electric Appliance Manufacturing Co., Ltd. (Japan)

CHEMICAL MACHINERY AND EQUIPMENT. MONITORNG OF HEAVY OIL COMBUSTION GAS FOR POLLUTION CONTROL. *(Kagaku kikai to sochi. Kogai boshi no tame no juyu nensho gasu no kanshi). Text in Japanese. Kagaku Sochi (Plant and Process), 14(2):99-103, Feb. 1972.*

An infrared analyzer for sulfur dioxide in flue gas is described. The measurement range of the apparatus is 0-2000 vol ppm and the sampling rate is 1-3 l/min under normal conditions. The rate of response is 1 min for 90% response. This highly reliable apparatus has the following characteristics: a solid-state electric circuit; a compact constant temperature tank which has an automatic temperature control system with a stability of plus or minus 0.1 C; the light source sector and detector are in a closed system that can not be affected by outside atmosphere; the motor and sector form a magnetic coupling so that there is no measurement error caused by vibration and heat evolution of the motor.

24743 **APTIC NO. 45812**

California Univ., Livermore, Lawrence Radiation Lab.

TRANSMISSION ANODE X-RAY TUBE DEVELOPMENT. *In: Hazards Control. Rept. 41, TIS-4500, UC-41, p. 2-3, March 22, 1972. 2 refs.*

NTIS: UCRL-50007-71-3

A low power x-ray tube was developed to replace the isotope exciter in isotope excited x-ray fluorescence for trace element analysis. The design and operation of the tube are reviewed. The major features include a thin transmission anode; heavy collimation of the same material as the anode; a thin beryllium exit window; a biased field shaping electrode providing precise current control; completely stainless and ceramic construction to allow high temperature bake-out; and very small size.

24744 **APTIC NO. 45937**

Franklin GNO Corp., West Palm Beach, Fla.

BETA/VII PLASMA CHROMATOGRAPH. *12p., 1972.*

The plasma chromatograph TM is a new type of all-electronic, high-speed, ultra sensitive chemical analyzer. The instrument permits rapid analysis of samples at sensitivities several orders of magnitude greater than those available in other techniques (10 to -12 or to -11 power mole parts). Sensitivity improves as the time constant is increased. It operates at atmospheric pressure, and consists of an ion-molecule reaction region, operated to select either positive or negative ions, coupled to an ion mobility spectrometer. The ion-molecule complexes formed in the reaction region are separated in the spectrometer region to generate an ion arrival time spectrum, or a plasmagram. The plasmagram displays the individual ion peaks formed by the different ions originally in the sample. For detailed analysis, the instrument must be coupled in tandem to a mass spectrometer. The plasma chromatograph (PC) may be used either directly, or as a peak identifier for a gas chromatograph, or as an ionizer for a mass spectrometer. It can be applied to analyses of pesticide residues, organic pollutants, metabolites, flavors, essential oils, and alkaloid flavors. It can also be used for measuring any acetate, thiophene, and pyridene in medical diagnosis; and natural ions in atmosphere. Odors naturally emanating from typical drugs and explosives may be directly identified in air. The PC can detect bombykol and other insect pheromones directly in air. The instrument console consists of two instrument cabinets on a common base with large rubber tired casters for easy placement. It operates at 208 V or 230 V, 60 H2, 20 amp. maximum, 5 amp average. It weighs approximately 850 lbs. For grid pulse width of 50; 100; 200; 500; and 1000 micron/sec it reproduces peak position of or 0.1%; 0.1%; 0.2%; 0.4%; and 0.8% of full-scale drift time, respectively. Temperature control varies from ambient to 40 C and 425 C. Gas flow controller for carrier gas 100 ml/min and drift gas 1000 ml/min controls from 10 to 300 ml/min and 100 to 3000 ml/min, respectively.

24745 **APTIC NO. 46173**

A NEW AIR POLLUTION MONITORING SYSTEM. *(Nuovo sistema di controllo dell inquinamento atmosferico). Text in Italian. Ing. Chim. (Milan), 21(3):5-8, June 1972.*

A portable automatic analyzer for the continuous coulometric titration of atmospheric sulfur dioxide manufactured is suitable for use in measuring networks monitoring pollution levels in industrial areas. The unit consists of two interconnected plastic containers -- one enclosing the chemical section, the other the electronic section. A separate filtering section which separates dust, ozone, hydrogen sulfide, and other substances from the inspired air is connected with the chemical section by a teflon tube. Sulfur dioxide reacts in a thermostatic cell with an aqueous solution of sulfuric acid, potassium bromide, and bromine. An electric potential is obtained by means of a measuring and reference electrode proportional to bromine variation and thus to atmospheric SO2. Bromine in the reaction solution is regenerated by electrolysis of KBr. The accuracy of the analyzer is 0.01 ppm for SO2 levels below 0.07 ppm; its sensitivity below 10 micrograms SO2/cu m air.

24746 **APTIC NO. 45401**

Asakino, Kunihiko

APPLICATION OF RADIOACTIVATED ANALYSIS TO AIR POLLUTION. *(Hoshaka bunseki no taiki osen e no oyo). Text in Japanese. Bunseki Kiki (Analysis Instr.), 10(9):563-570, Sept. 1972. 5 refs.*

Radioactivation analysis of elements by neutron irradiation includes the neutron irradiation, analysis of gamma-ray spectra, determination of the nucleus, and calculation of gravity. Following neutron irradiation, a stable element changes into a radioactive isotope which decays with a characteristic half-period value and forms another stable element. By measuring the gamma-ray spectra and half-period value of the radioactive isotope, it is easy to determine the original stable element. The relative gravity of the element can be calculated with a computer by using data from the gamma-ray spectra. Approximately 30 elements have been simultaneously detected in 20-50 cu m of air sample by using a germanium (lithium) semiconductor detector. The method has also been successfully applied to determinations of manganese and bromine in air.

24747 **APTIC NO. 45785**

Black, Francis M. and John E. Sigsby

A TOTAL CHEMILUMINESCENT METHOD FOR NO AND NOX (NO + NO2) ANALYSIS. *Preprint, Envirnomental Protection Agency, Research Triangle Park, N. C., Div. of Chemistry and Physics, 23p., 1972 (?). 12 refs.*

An instrumental method was developed which will permit rapid, sensitive measurement of nitric oxide and oxides of nitrogen (nitric oxide plus nitrogen dioxide) by chemiluminescent techniques. Nitric oxide is measured by photoelectric amplification of a signal produced by the chemiluminescent reaction of nitric oxide and ozone, while oxides of nitrogen are measured by photoelectric amplification of a signal produced by the chemiluminescent reaction of the oxides of nitrogen with atomic oxygen. Atomic oxygen is produced by gas phase thermal decomposition of ozone. The apparatus, reactions, and results are described. (Author abstract modified)

24748 **APTIC NO. 46377**

Buehne, Karl-Wilhelm and Ludwig Duewel

RECORDING DUST EMISSION MEASUREMENT IN THE CEMENT INDUSTRY WITH THE SMOKE DENSITY MEASURING UNIT RM 4 OF THE COMPANY SICK. *(Registrierende Staub-Emissionsmessungen in der Zementindustrie mit dem Rauchdichtemessgeraet RM 4 der Firma Sick). Text in German. Staub, Reinhaltung Luft, 32(8):329-334, Aug. 1972. 11 refs.*

In a large cement plant a complete suitability test was carried out with the photoelectric RM4 device for measuring smoke density according to the directives issued by the Federal Minister of Internal Affairs of the West German government. The investigations were conducted in a laboratory and under real operating conditions in an industrial plant. With the help of comparative gravimetric measurements, the relation between the recorded extinction and the gravimetric dust content was determined for all situations occurring during the operation. The measuring device satisfied the fixed minimum requirements in every respect. There was a definite linear relationship between extinction and dust concentration. A random assessment of the recording tape, when the evaluated calibration curve was used, gave more reliable evidence on emission behavior during continuous operation than that which can be obtained by occasional individual measurements.

24749 **APTIC NO. 46088**

Cook, S. Charles, George W. Bethke, and William D. Conner

REMOTE MEASUREMENT OF SMOKE PLUME TRANSMITTANCE USING LIDAR. *Appl. Opt., 11(8):1742-1748, Aug. 1972. 8 refs.*

A van-mounted ruby lidar system has been developed for the remote single-ended measurement of smoke plume transmittance at ranges of 150 to 500 m. The transmitter of the mobile lidar system consists of a 1 cm by 7.3 cm ruby laser, and a rotating prism Q-switch. It has a 30 n sec pulse width. Its maximum output is 1 J, the repetition rate is 3 ppm. Cooling is done by means of deionized water. The receiver consists of objective lens 15.25, f/5 and an Amperex 56 TVP (S-20) photomultiplier. The measurement of transmittance is obtained by comparing the clear air lidar return from the near side of the plume with that from the far side. The synthetic target testing demonstrated the accuracy of the single-beam, single-shot lidar technique for the remote single- ended measurement of plume transmittance and showed the major accuracy limitation to be due to photomultiplier tube afterpulsing. This caused a maximum systematic error (assuming maximum plume reflectance at a given remittance) of over +12% for T bigger than 0.50 and 2.5% for T larger than 0.80, where T is the laboratory determined transmittance. This error decreased as plume reflectance decreased at a given transmittance and should, in principle, vanish for a black (zero reflectance) plume. Since any error is always positive, the lidar measurement inherently yields an upper limit value for the transmittance. The plume-to-shy contrast (visibility) can be correlated with plume transmittance only under constant plume illumination conditions that in general are not the case. This makes the lidar technique attractive since it provides an absolute, remote measure of plume transmittance that requires only a clear optical path to the plume and is independent of ambient lighting conditions. Field operation of the lidar system using real smoke plume targets had demonstrated agreement, within the present accuracy of the lidar technique, between simultaneous lidar and telephotometer transmittance measurements.

24750 **APTIC NO. 45592**

Cross, Frank L., Jr.

INTRODUCTION TO EMISSION TESTING. *Preprint, 15p., 1972. (Presented at the Area-Wide Industry Group, Geismar, La., March 9, 1972.)*

The principal reason for monitoring is to obtain hard data that can be used to make decisions in qir air quality management. There are several methods of determining the losses from a process, including material balances, emission inventories, and source testing. The trend in emission standards is to become more stringent. A number of sampling trains have been designed and developed for source testing. Isokinetic sampling has a significant influence on the type of equipment used in source testing. It helps obtain representative results in collection of particles larger than 5 micron in diameter. Investigations conducted at cement plants and incinerators revealed a lack of significant data points when applying the Office of Air Programs method. There was also a wide variation in the data. Many of the newest existing plants do not meet the proposed standards. The increasing stringency of emission standards, the on-going discussion of test methods, and the application of standards to more pollutants have created a demand for test methods and equipment of greater technical sophistication. Illustrative of the recent developments stimulated by this demand are the electrochemical transducer for monitoring nitrogen oxides, sulfur dioxide, and Beta-ray sensor system for particulates. These devices are still in the development stage, and much additional research must be performed. (Author conclusions modified)

24751 **APTIC NO. 45932**

Cross, Frank L., Jr.

GASEOUS SOURCE SAMPLING. *Preprint, Weston (Roy F.), Inc., West Chester, Pa., 14p., 1972. 13 refs.*

When sampling for gases, it is necessary to study the temperature variation across the stack. This is done as part of the velocity traverse and indicates variation in gas distribution. If the temperatures are relatively constant, then a single sampling point may be all that is necessary. If temperature variation is considered to be large (greater than 5%), traversing is necessary and is usually done at the same points used in the velocity traverse. The sampling rate and time of sampling at each point are often kept the same to simplify calculations. Stainless steel is usually an acceptable probe material. Glass may also be used, but its fragile nature makes it less desirable. In some special applications Teflon is the preferred material. Best are glass, Teflon, Tedlar, or Mylar bags. In all cases, minimum probe lengths should be used, and extended flushing with stack gas should precede sample collection. This flushing is very important if losses to the walls of the probe and sample collector are to be avoided. Often the entire sampling system must be heated to prevent condensation of water, heavy hydrocarbons, or sulfuric acid mist. The recommended methods of gaseous source sampling are reviewed in a table. These include colorimetric, coulometric, conductometric, spectrometric, gas chromatographic, photometric, and paramagnetic methods. Continuous monitoring is being adapted for source sampling. Sampling costs for sulfur dioxide, particulates, and nitrogen oxides are given.

24752 **APTIC NO. 45944**

Cross, Frank L., Jr.

ISOKINETIC SAMPLING. *Preprint, Weston (Roy F.), Inc., West Chester, Pa., 18p., 1972. 4 refs. (Presented at the Monitoring and Analysis Techniques, 4th Annual Course on Environmental Quality Control, Massachusetts Univ., Amherst, May 15-18, 1972.)*

Isokinetic and anisokinetic sampling are described. Isokinetic sampling is a technique for obtaining a representative sample of particulates from stack gases. Sampling for particulates requires more detailed concern about the sampling rate than does gas sampling. Inertia effects become more significant when particle size exceeds about 3 micron diameter. If a reasonable proportion of the particles exceed this size, isokinetic sampling is necessary. The Environmental Protection Agency is of the opinion that samples that are more than about 10% from isokinetic (nozzle-velocity)/(stack-velocity) should be rejected and sampling repeated. Null sampling probes, however, do not guarantee isokinesis because there may be differences in velocity between the inside and outside of the probe. With the new EPA Sampling Conditions set at + or 10%, isokinetic null probes will not be satisfactory in the future. Through the use of nomographs, the EPA train can be used for particulate sampling and can satisfy the new EPA definition of + or 10% isokinetic. Anisokinetic sampling occurs when there is a significant difference between the velocity in the nozzle and the velocity in the stack or duct. Beta attenuation is discussed. A commercial instrument is available that permits a particulate measurement every 15 to 30 min. The EPA test procedure is discussed. It includes formulas for calculations, details of sampling train, and forms for recording data. (Author conclusions modified)

24753 **APTIC NO. 46327**

Cross, Frank L., Jr.

AIR FLOW IN STACKS. *Preprint, Weston (Roy F.), Inc., West Chester, Pa., 26p., 1972. 5 refs. (Presented at Monitoring and Analysis Techniques, the 4th Annual Course in Environmental Quality Control, Massachusetts Univ., Amherst, May 15-18, 1972.)*

A method of calculating air flow in stacks, including the apparatus, sampling point, proportional sampling, data collection, and calculations, such as determination of gas density, sample calculation, and calibration of pitot tubes is presented. Equipment required is described. The apparatus utilized to measure velocity is composed of a pitot tube, differential-pressure gauge, temperature gauge, barometer, and gas analyzer. Proportional sampling includes selection of sampling site and a minimum number of traverse points, setting of apparatus, measuring temperature of stack gas, measuring static pressure in the stack; determining stack gas molecular weight by gas analysis, and finding the velocity correction factor for a pitot tube. The equipment utilized in calibration consists of a steel pipe about 12 in. in diameter, one end of which is connected to an air blower which delivers a stream of air through pipe. Air velocity through pipe is controlled by a conical piece of wood placed at the exhaust end, in such a way that the area of the exhaust opening can be varied by changing the position of wood cone. Draft readings are made by two manometers calibrated in water. Typical reading data under unsatisfactory conditions vary between 0.360 and 0.35 for a standard to 0.495 to 0.056 for a pitot tube being calibrated. The factors used in the formula are velocity of flue gas, pitot tube correction factor, absolute pressure of flue gas, specific gravity of flue gas, differential reading of draft gauge, and absolute temperature of flue gases. This calculation gives the value of velocity correction factor of pitot tube being calibrated. During measurements values of the velocity correction factor ranging between 0.852 to 0.791 were obtained, by calculating differential readings of draft gauge of tube calibrated, which ranged between 0.495 to 0.056, and differential readings of draft gauges of the standard pitot tube, which ranged from 0.360 to 0.035. (Author conclusions modified)

24754 **APTIC NO. 46152**

Deraygin, B. V. and A. I. Storozhilova

CONDENSATION METHOD OF RECOVERING HIGH-DISPERSIVE FRACTION OF BIOLOGICAL AEROSOLS AND DETERMINATION OF THEIR QUANTITATIVE CONCENTRATION. *(Kondensatsionnyy metod ulavlivaniya vysokodispersnoy fraktsii biologicheskikh aerozoley i opredeleniye ikh chislennoy kontsentratsii). Text in Russian. Zh. Mikrobiol. Epidemiol. Immunobiol., 49(4):54-57, 1972. 4 refs.*

A condensation method is described for recovering biological aerosols and determining their quantitative concentration. Droplets appearing on small aerosol particles under conditions of oversaturated steam precipitate due to gravitation and diffusion forces into a nutrient water medium. Condensation of droplets can be conducted at any mean positive air temperature in a special cuvette, and the nutrient media can be sampled for analysis once or continuously. This method is convenient for work with biological aerosols when their radius lies within the range between 0.000001 and 0.0001 cm.

24755 **APTIC NO. 45445**

Gnyp A. W., S. J. W. Price, and C. C. St. Pierre

PROBLEMS IN STACK SAMPLING: PART II--TAKING THE FIRST STEPS. *Water Pollution Control (Toronto), 110(7):40-42, July 1972. 2 refs.*

Source testing is carried out to provide a measure of the effectiveness of pollution control equipment or to evaluate the amount and kind of air pollutants being discharged from any particular source. Before any serious testing is carried out the supervisor s first objective is to become familiar with the general operations of the source to be evaluated through a preliminary survey. Data normally acquired at this stage would provide reasonably accurate estimates of the physical dimensions and layout of the ducts or stacks to be tested; process feed rates; fuel rates; mode of source operation; normal operating and stack temperatures and pressures; volumetric flow rates; gas compositions; moisture content of gas streams; dust loadings; and chemical and physical properties of the particulate matter in the gas streams. Potential sampling locations are then evaluated, and preliminary tests made. Gas velocity, total gas flow, gas temperature, and static pressure measurements are discussed.

24756 **APTIC NO. 46365**

Grimmer, Gernot, Hildebrandt Armin, and Heinz Boehnke

SAMPLING AND ANALYTICS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AUTOMOBILE EXHAUST GAS. I. OPTIMIZATION OF THE COLLECTING ARRANGEMENT - ENRICHMENT OF THE POLYCYCLIC AROMATIC HYDROCARBONS. *(Probenahme und Analytik polycyclischer aromatischer Kohlenwasserstoffe in Kraftfahrzeugabgasen. I. Optimierung der Sammeleinrichtung - Anreicherung der polycyclischen Kohlenwasserstoffe). Text in German. Erdoel Kohle (Hamburg), 25(8):442-447, Aug. 1972. 14 refs.*

The optimization of a simple collecting method for polycyclic aromatic hydrocarbons of the boiling range from 338-500 C includes careful filter selection, correct exhaust gas temperature in relation to cooler surfaces, and impregnation of filter material. The separation rate of the filter combination in the test is controlled under operating conditions (at the chassis dynamometer) by a double filter of silica gel. The collecting equipment consists of a glass cooler (length about 900 mm, cooling surface 0.25 sq m) and a micron filter (350 by 165 mm) of impregnated fiber glass material. The micron filter has a separation degree of 99.998% for particles of 0.3-0.5 micron at a nominal air rate of 50 cu m/hr and a maximum flow resistance of 15 mm water column (equals 20 kp/sq m). A multistage method for the enrichment of the polycyclic aromatic hydrocarbons from the separated particle phase is described.

24757 **APTIC NO. 46385**

Guenther, Peter

EXACT MEASUREMENT - CLEANER AIR. *(Exakte Messung - reinere Luft). Text in German. Tech. Umweltmag., no. 4:34, Aug. 1972.*

Gas chromatography in combination with a flame ionization detector (FID) can selectively measure carbon monoxide, methane, and total hydrocarbons. Interferences by other components can be avoided by adequate selection of the separating columns. Carbon monoxide is converted to methane prior to the measurement with the FID. Phosphorus and sulfur compounds can also be determined with high accuracy. The disadvantage of the method is its dependence on supply units. A gas chromatograph with FID and CO catalyst requires at least a combustion gas (hydrogen), air, and a carrier gas for the analytical separation system. Hydrogen can be produced electrolytically with the required purity and can be used as a carrier gas. Air of the required purity can be produced via a compressor with connected cleaning system. Gas chromatography in connection with the FID is a suitable method for air monitoring because all concentrations down to 1 ppm can be measured.

24758 **APTIC NO. 45703**

Hogstrom, Ulf

A METHOD FOR PREDICTING ODOUR FREQUENCIES FROM A POINT SOURCE. *Atmos. Environ., 6(2):103-121, Feb. 1972. 10 refs.*

An experiment was performed at Monsteras, Sweden, indicating that it is possible to make quite realistic estimates of absolute odor frequencies near a point source with the fluctuating plume dispersion model, when the odor threshold of the chimney gases is determined by sensory methods. The theoretical calculations are compared with observational results from a field experiment at and around a sulfate pulp factory in Sweden. Trained observers were used, making a large number of instantaneous observations of odor in the outdoor air at a variety of locations around the factory. Even if the experiments for 2 and 5 km give results 20 to 70% higher than calculated, there is no systematic difference between the calculated and the observed frequencies in the range of 2 to 5 km from the source, if the result of the sector experiment as well as the car experiment is taken into account. For the distance range of 10 to 20 km the calculated frequencies are significantly lower than the observed ones (by about 25%), but is is likely that even the result obtained for that distance may be acceptable for many practical purposes. The possible reasons for the increasing discrepancy between observed and calculated frequencies with distance are discussed in detail, and it is not possible to tell with certainty whether it is caused mainly by a change in the chemical and/or physical composition of the plume with distance, or if it is due to the assumptions of the dispersion model, or whether it is simply a statistical effect. The relevance of the absolute odor frequency concept as a measure of perceived odor frequency within a population cannot be stated today, but is is possible to modify the method so that it may cope with a more sophisticated dose description. It is difficult to tell how generally valid the method is from one field experiment, but there is reason to believe that fairly accurate results can be obtained for any reasonably flat area. The Monsteras area is not ideal. It is fairly broken and partly covered with woods.

24759 **APTIC NO. 45430**

Honma, Katsunori

MEAN PARTICLE SIZE MEASURING METHOD FOR AEROSOL USING FILTER COLLECTION MECHANISM. *(Roka hoshu kiko o riyo shita earozoru no heikin ryukei no sokuteiho). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 14(4):340-341, July 1972.*

Experiments were conducted with simple dispersion aerosols to determine the relationship between collection efficiency and aerodynamic particle diameter. The test aerosols and their specific gravities were lead, 11.34; tellurium, 6.2; and stearic acid, 0.9. There was an intimate relationship between the collection efficiency and the aerodynamic particle diameter, and particles of approximately one micron in size were measured with high accuracy.

24760 **APTIC NO. 45652**

Hosemann, Peter J.

ASPECTS OF THE TESTING OF SMOKE INDICATORS. *(Gesichtspunkte bei der Pruefung von Rauchmeldern). Text in German. Staub, Reinhaltung Luft, 32(7):290-293, July 1972.*

Smoke indicators based on light transmission, scattering, or ionization react exclusively to certain characteristics or various combinations of characteristics of the disperse phase of smoke. These characteristics are particle diameter or the statistical diameter distribution, particle shape, inner particle structure and the aggregate form of particles, plus the number of particles/volume unit and the various chemical, physical, and optical constants. Any change in one of these parameters changes the type of smoke and with it the respective measured value. The measured value furthermore depends on the design characteristics of the instrument itself and the complex refractive index of a particle, which is influenced by the wavelength of the light. Two different smoke indicators for one particular smoke situation are compared to illustrate the difficulties of assessing the quality of a smoke indicator. A comparison of the performance of an ideal light-scattering indicator with an ideal light-transmission indicator at the application of a smoke whose so-called absorption constant of particles is zero, favors the scattering indicator. A similar comparison with a smoke whose absorption constant is rather large turns out in favor of the light transmission indicator. Each smoke indicator should be tested with many kinds of smoke to determine its real capacities. Sometimes a combination of indicators is required for satisfactory results.

24761 **APTIC NO. 45422**

Ishiguro, Tatsukichi

VARIOUS METHODS OF MEASUREMENTS AND EVALUATION OF ODOR POLLUTANTS AT THE EMISSION SOURCES AND ENVIRONMENT (II). *(Hasseigen ya kankyo ni okeru akushu osenshitsu no sokutei ya hyoka no sho-hoho (II)). Text in Japanese. Akushu no Kenkyu (Odor Research J. Japan), 2(7):19-21, Aug. 1972.*

A general discussion is given on the measurement and evaluation of odorous pollutants. When humans are exposed to the environment, the dose depends not only on the exhaust gases, but also on the distance from the sources, the chemical stability of the gas, meteorological conditions, geographical condition, etc. Therefore, it is necessary to have a clear indication of dose-response while evaluating pollutants. The quantitative analysis of odorous pollutants by physico-chemical method has been more difficult than by sensory methods. However, the situation is gradually changing due to the development of new techniques. Some definitions used for studies of odors are also given.

24762 **APTIC NO. 45739**

Ives, N. Fred and L. Giuffrida

LIQUID CHROMATOGRAPHY OF POLYNCYCLIC AROMATIC HYDROCARBONS. *J. Assoc. Offic. Anal. Chemists, 55(4):757-761, 1972. 22 refs.*

The liquid chromatography of 18 polycyclic aromatic hydrocarbons (including anthracenes, pyrenes, perylenes, chrysenes, and fluoranthenes) was investigated using a continuous monitoring ultraviolet spectrophotometric detection system. Two column materials, Durapak OPN and 40% cellulose acetate, were compared for orders of elution and resolution. Neither system resolves all the compounds tested, but the use of more than one system increases the number which may be resolved. The potential of analytical liquid chromatography for the resolution and analysis of such compounds was shown. (Author abstract modified)

24763 **APTIC NO. 46117**

Kanagawa, Akira

SIZE DETERMINATION OF AEROSOL PARTICLES BY OWL-TYPE PHOTOMETER -- EFFECT OF WAVELENGTH RATIO-- (Owl gata fotometa ni yoru enmutai ryukei sokutei - hachohi no eikyo). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 36(6):647-653, June 1972. 5 refs.

The angular distribution of scattered light intensity from aerosol particles was determined by a parameter alpha, which is a function of the ratio of diameter to wavelength, and refractive index m. However, it is usually difficult to estimate the size of aerosol particles by the angular distribution. Theory and mathematical equations are introduced to determine scattering angle distribution. The effect of wavelength ratio is discussed. A figure is presented of the angular dependence of the ratio Rl of long wavelength scattering light intensity, vertically polarized to short wavelength as a function of the wavelength ratio at a particle size parameter with a long wavelength equal to 2.0 and a refractive index of 1.6. A figure is presented of angular position of peaks of the ratio Rl of long wavelength scattering light intensity, vertically polarized, to short one as a function of the wavelength ratio at a particle size parameter with the long wavelength equal to 1.5 and the refractive index of 1.5. The distribution of diameters of particles is discussed with mathematical equations. A figure is presented of the angular dependence of the ratio RI of long wavelength scattering light intensity, verically polarized, to a short one as a function of the logarithm of the geometric standard deviation at a wavelength ratio of 1.1, geometric mean of particle size parameter with the long wavelength equal to 3.0 and a refractive index of 1.5. The ratio of the long wavelength to the short one by an Owl-type photometer was estimated about 1.3.

24764 **APTIC NO. 46187**

Kudo, Akira and Kanji Takahashi

A METHOD OF DETERMINING AEROSOL PARTICLE SIZE DISTRIBUTION APPLYING BOLTZMANN'S LAW. *Atmos. Environ., 6(8):543-549, Aug. 1972. 8 refs.*

An experimental evaluation was conducted on a method for determination of submicron aerosol particle size distribution. The method utilizes prediction curves based on Boltzmann's charge distribution law and measurements of particle number concentration measured by a condensation nucleus counter related to the electrical mobility. Measurements of metallic fumes showed fair agreement with the prediction curves of size distribution. The curves were derived from direct electron microscopic observation of the fumes. For lead fume, the measurement falls within a range of plus or minus 10% of the prediction curve. At present, there are some problems in achieving a lower critical mobility in the analyzer. There are three possibilities to attain this requirement: by increasing the voltage, increasing the electrode length, and reducing the electrode clearance. (Author abstract modified)

24765 **APTIC NO. 46258**

Lederman, Samuel

MEASUREMENT OF NO CONCENTRATION IN WATER SATURATED NITROGEN. *Appl. Opt., 11(9):2088-2089, Sept. 1972. 4 refs.*

Raman spectroscopy was utilized for the quantitative determination of nitric oxide in a water saturated gas mixture. The Raman effect, which is the result of an inelastic collision of a photon with a molecule, does essentially cause the affected molecule to undergo a double transition by first absorbing and then emitting a photon. The experimental equipment comprised a Q-switched ruby laser, scattering chamber, optical system, photomultiplier, and other accessories. The concentration of NO as measured die not exhibit any dependence on the presence of other species in the mixture. The ratio of water vapor to NO concentration increased with the decrease of NO concentration. The resolution remained substantially linear down to about 0.5 torr of NO; this concentration corresponds to a resolution of 1000 ppm. With the increase of the frequency of the primary light and with improved data handling and processing, the resolution of 1 ppm can easily be achieved.

24766 **APTIC NO. 46172**

Lindvall, Thomas, Birgitta Berglund, Ulf Berglund, and Erland Jonsson

MAN AS MEASURING INSTRUMENT. *(Manniskan som matinstrument). Text in Swedish. Lakartidningen, 69(23):2797-2803, 1972. 13 refs.*

Problems and possibilities of psychological and sociological methods to determine accurate measurements of the environmental pollution load are reviewed. Examples of behavioral studies in damaged environments are given. More or less subjective annoyance reactions of populations along with proven or suspected health hazards are regarded as important factors in the evaluation of environmental nuisances. Such nuisances may be produced by biological, physical, and psychosocial stimulations which may generate physiological or psychological reactions. While the human organism possesses adaptability to environmental nuisances, neither its extent, nor the limit to which its exploitation is acceptable, are known. The attitude of populations toward environmental nuisances can be influenced by psychological means. Community noise, malodorous emissions, dust, litter, and crowding are among the physical nuisances commonly experienced. The sensory evaluation of such nuisances may be as reliable, or even more valuable than physical measurements, which is exemplified by sensory studies of malodorous emissions from a sulfate pulp plant and of traffic noise. The direct relationship between nuisance perception and dose was determined. Psychological, sensory methods of nuisance evaluation are valuable in community planning.

24767 **APTIC NO. 45802**

Luiga, Peeter, Reet Liiv, and Roman Ott

INVESTIGATION OF THE LA/AC COLORIMETRIC METHOD FOR THE DETERMINATION OF AIRBORNE FLUORIDES. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 13p., 1972. 5 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-1.)*

The influence of various test conditions was investigated in the lanthan-alizarin complexan (La/AC) and fluoride reaction in order to establish optimum conditions for achieving high sensitivity and reproducibility of measurements. Photocolorimetric investigations were made in both the visible and the ultraviolet region of the spectrum. Solutions of standard fluoride, alizarin-complexan, lanthan-nitrate, and acetate buffer were prepared. Acetone, acetonitrile, methanol, ethanol, propanol dioxane, and dimethylformamide were compared for their effects on solution sensitivity. Of the tested solvents, acetone was the most suitable; its optimum rate in the final solution was 33%. Introduction of acetone cut down the stabilizing time in the reaction of the La/AC solution with the fluoride sample from 1 hr to 20 min, and sufficiently stabilized the solution for 24 hrs or more. Difference in optical density at 618 micron between the test solution and the corresponding blank appeared to be a maximum at pH 4.3. In the ultraviolet region of the spectrum at 280 micron, methanol, ethanol, propanol, and dimethylformamide were utilized because of the high absorbance of acetone. As a result, the sensitivity in the ultraviolet region was more than 50% higher than the sensitivity in the visible region. Except for sulfite, all the ions investigated had approximately the same effect on the density of the test solution in both the visible and the ultraviolet region. The diverse interference of sulfite was eliminated by its oxidation with hydrogen peroxide. The diverse effect of total sulfates was eliminated by their precipitation with benzidinhydrochloride. Aluminum ion was successfully eliminated by kationite. The ratio of lanthanum (III) to alizarin-complexan solutions, the rate of buffer, the type and the amount of the organic solvent and the pH value have considerable effect on the sensitivity of the method. The optimum values of these factors are in some cases dependent upon each other and on the fluoride concentration. (Author abstract modified)

24768 **APTIC NO. 46277**

Mallon, Harry J. and Joan Y. Howard

PROPOSED EXPERIMENTAL PROGRAMS FOR TESTING REMOTE SENSING APPLICATIONS IN THE METROPOLITAN WASHINGTON AREA. (FINAL REPORT). *Metropolitan Washington Council of Governments, Washington, D. C., Geological Survey Contract 14-08-0001-12708 and National Aeronautics and Space Administration Contract W-13318, Proj. 160-75-71-03, USGS-DO-72-001, 21p., Feb. 1972. 9 refs.*

NTIS: PB 207524

An investigation was undertaken to assess the utility and value of remote sensing data as an information source in support of the Metropolitan Washington Council of Governments s urban and regional planning programs. Areas of study have included land use, urban growth and change detection, natural features, transportation, housing, water run off, thematic mapping and updating, sedimentation, pollution, photo research services, training, and other miscellaneous uses. The referenced studies have utilized, assessed, or discussed remote sensor data acquired from several types of platforms: fixed-wing aircraft at high and low altitudes; rotary-wing aircraft; and by projection, imagery from the expected Earth Resources Technological Satellite Program. Experimental design of the Earth Resources Technological Satellite Program is described, including the data acquisition systems, the experimental program, and methodology for data utilization.

24769 **APTIC NO. 46122**

Malyarova, L. K. and N. Ye. Nesterova

DETERMINATION OF AROMATIC COMPOUNDS (BENZENE AND ITS HOMOLOGUES) IN AIR BY MEANS OF GAS-LIQUID CHROMATOGRAPHY. *(Opredeleniye aromaticheskikh soyedineniy (benzola i yego gomologov) v vozdukhe metodom gazo-zhidkostnoy khromatografii). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 4:58-60, 1972. 5 refs.*

A procedure for the gas-liquid chromatographic determination of benzene and its homologues (toluene, m-, p-, o-xylene, ethylbenzene, and isopropylbenzene) in air is described. Nitrogen and diatomite and gaseous and solid carriers, respectively, were used; apiezon, silicone fluid, dinitrobenzene, benton-245, and beta1beta-oxidipropionitrile were applied as the stationary phase. The sampling was done by means of a gas pipette from which a volume of 1-3 ml was transferred into the chromatograph when the concentration was in a range of 10-100 mg/cu m. Another sampling method, applying adsorption tube with clay at a temperature of -70 C and a sampling rate of 0.5 l/min provided improved sensitivity. Preliminary concentration on silicagel at room temperature was applied in another sampling method. The quantitative analysis was done by means of absolute calibration. The lower limits of detectability for benzene, toluene, ethylbenzene, xylenes, and isopropylbenzene were 0.1, 0.4, 0.6, 0.7-1.0, and 2.3 micrograms, respectively. A relative error of plus or minus was determined.

24770 **APTIC NO. 45772**

Matsumura, Ikutoshi

MICROANALYSIS OF ODOR COMPENENTS FOR ODOR POLLUTION CONTROL. *(Akushu kogai kaiketsu no tameno biryo shuki seibun no bunseki ho). Text in Japanese. Seikyu Gakkai-Shi (J. Japan Petroleum Inst., Tokyo), 15(7):596-600, July 1972. 5 refs.*

Since olfactory threshold values of odors in the atmosphere are small, analysis of such substances in the atmosphere is extremely difficult. The olfactory threshold values determined by the odorimetry panel members were much lower than those given in the references; for example, 0.014 ppm for hydrogen sulfide compared with 0.13 ppm, and 0.0085 ppm for methyl mercaptan compared with 0.041 ppm. Gas chromatography using a Flame Photometric Detector was used for the analysis. Odor was taken into a dehydration tube dipped in isopropyl alcohol of -28 C to -30 C. After dehydration there, the odor was led into the U-shaped absorption tube packed up with C-22 absorbent (fire brick powder). The absorption tube was cooled with a mixture of dry ice and isopropyl alcohol of -78 C to concentrate the odor. Although another odor concentration method, in which glass beads are used instead of C-22 and the absorption tube is cooled to -190 C with liquid oxygen or nitrogen, gives better results including a recovery rate of 100%, this method was chosen for better operational ease. Absorption, desorption, and recovery rates of C-22 were 100 vol%, 16 vol%, and 16 vol%, respectively, for hydrogen sulfide. For methyl mercaptan, they were 100, 72, and 72. Therefore, concentration values determined by the gas chromatograph should be corrected by taking into account these factors for the odor substance concerned. The makeup and use of the desorption device and FPD, the analysis conditions, and the qualitative and quantitative determinations of the odor substance in this microanalysis method were explained.

24771 **APTIC NO. 46098**

Paules, Paul E. and Robert J. Bambeck

PRACTICAL APPLICATION OF A FAST RESPONSE CONTINUOUS BOILER FLUE GAS MONITORING SYSTEM. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 15p., 1972. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-71.)*

A continuous fast-response boiler flue gas monitoring system which requires no external sampling system and measures an integrated sample within the stack is currently in use. Up to four gases plus opacity may be monitored simultaneously and continuously with real time data provided on a strip chart recorder. The instrument design, concept, applications, and actual experience with operating instruments are discussed. The Environmental Data Corporation monitoring system consists of a light source, analyzer, and recorder. Mounting is usually handled by installing a pipe in the stack or breaching duct with the source mounted on one end and the analyzer on the other. The light source emits radiation in the broad range where the monitored gas absorbs. The polychromatic beam is collimated and transmitted across the stack. The analyzer receives the polychromatic beam and processes it to produce a signal, the amplitude of which is proportional to the spectral absorption of the gas being monitored. This signal is then compared to the unabsorbed background light level through the flue gas. The signal produced is a function of the mass of monitored gas present in the light beam at a given time. Reductions in light level through the optical system can approach 80% without affecting the accuracy of the reading. The response time of the system from gas-composition change to 90% recorder read-out is about 4 sec. Because of its simplicity, its elimination of a sampling system, and its rugged design, this monitor has shown an extremely high reliability factor. At Southern California Edison Company Generating Units, time out of service due to instrument malfunction is now averaging less than 1% overall. The initial 28 units were installed about one year ago. (Author abstract modified)

24772 **APTIC NO. 46360**

Poetschke, Herbert

AIR MONITORING AND AIR CLEANING. *(Luftueberwachung und Luftreinigung). Text in German. Wasser Luft Betrieb, 16(9):283- 287, 1972.*

Brief descriptions of the operating principles of the pollution measuring units Uras, Picoflux, Picos, and Fidas are given. The Fidas, measures combustible organically bound hydrocarbons. The Picos measures hydrogen sulfide, nitric oxide, nitrogen dioxide, and chlorine. The infrared gas analyzer Uras uses the specific radiation absorption of multi-atomic non-elementary gases in the infrared spectral range of 2.5 to 12 micron. The Picoflux measures the conductivity of a reactant before and after the reaction with the gas to be measured. The trace gas analyzer Picos uses two silver metal electrodes in an organic electrolyte. For indoor air monitoring, various oxygen analyzers are described. For the removal of gaseous air pollutants, the so-called Adsox plant has been developed consisting of a combination of adsorption filter and catalytic afterburning. For the removal of dusts, vapors, and gases the airator is used; the unit comprises an exhaust hood with a 0.6 m long flexible steel hose to which a 2.5 m long highly elastic rubber hose is attached. An airmover blower with an annular nozzle supplies compressed air into a funnel-shaped hollow space. The entering compressed air produces a vacuum in the funnel which permits considerable air quantities to be drawn off.

Brief descriptions of the Vario-venturi scrubber used by the iron plant in Kaiserslautern and of a fully automatic tubular cloth filter are given.

24773 **APTIC NO. 46353**

Polydorova, Marie

AUTOMATIC UNIT FOR DETERMINATION OF THE AEROSOL CONCENTRATION. *(Automatisches Geraet zur Bestimmung der Aerosolkonzentration). Text in German. Staub, Reinhaltung Luft, 32(8):321-322, Aug. 1972. 1 ref.*

An aerosol concentration measurement device which works by filtering air through a moving filter band was studied. The dust trace was irradiated by light, and photometric values were recorded continuously. To calibrate the instrument, parallel gravimetric measurements were carried out. Concentrations determined for different aerosols were influenced by the dust color.

24774 **APTIC NO. 45346**

Reist, Parker C.

THE SCANNING ELECTRON MICROSCOPE IN AIR POLLUTION STUDIES. *Clean Air, 6(2):26-29, May 1972. 24 refs.*

The scanning electron microscope is a device which uses a narrow beam of electrons to interrogate a very small section of a sample specimen and to synchronously display an image of that specimen on a cathode ray tube screen. With the recent commercial introduction of the scanning electron microscope, the potential for improvement in visualization of small aerosol particles has been greatly enhanced. Some of the applications of scanning electron microscopy to air pollution studies are discussed, including operation of the microscope, sample collection and preparation, and advantages and disadvantages of studying small particles in this manner. Dust analysis, particulate studies, the pore size distribution of membrane filters, use of the scanning microscope to size replicas of water droplets, and the feasibility of coupling a scanning electron microscope to a small electronic computer are mentioned. A technique has recently been suggested for discerning between asbestos fibers and other less hazardous ones. Actual deposition sites within different compartments of the lung can be observed using a scanning electron microscope to give a direct visual picture of the patterns of deposited particles in the respiratory system.

24775 **APTIC NO. 45851**

Rodes, Charles E., Richard M, Felder, and James K. Ferrell

POLYMERIC BARRIERS AS INTERFACES IN STACK SAMPLING. *Preprint, American Chemical Society, Washington, D. C., 29p., 1972. 10 refs. (Presented at the American Chemical Society, National Meeting, 163rd, Boston, Mass., April 10, 1972.)*

The feasibility of using a cylindrical polymeric tube as a permeable separation interface between a stack and a continuous ambient sulfur dioxide monitor was investigated. Isothermal flux measurements were carried out over a range of SO2 concentration using 0olytetrafluoroethylene, silicone rubber, and fluorosilicone rubber tubes. Permeabilities were calculated from flux concentration curves, and the activation energy for the permeation process was determined for each material. The measured flux of SO2 permeating through the tube wall varied linearly with the trans-wall concentration gradient. The effect of temperature on the slope of the flux vs. concentation curve was approximately four times greater for polytetrafluorethylene than for either silicone or fluorosilicone rubber. The relaxation times for the materials tested depended on the temperature and the wall thickness, and were of the order of minutes. The polymer tube interface is a promising device for stack monitoring. (Author abstract modified)

24776 **APTIC NO. 45853**

Ross, Robert M.

AN AUTOMATIC MONITOR FOR AIRBORNE PARTICULATES. *Preptint, Air Pollution Control Assoc., Pittsburgh, Pa., 26p., 1972. 5 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-16.)*

A new automatic monitor for continuous near real time measurement of airborne particulates is described. The Particulate Air Monitor (PAM) automatically samples a large volume of air (17-35 cu ft/min), collects the particulates on a high efficiency glass fiber filter, conditions the particulates to constant weight, automatically weighs the filter, and outputs a DC voltage proportional to the collected mass. Air flow is operator adjustable and then automatically maintained by a feedback loop that speed controls the universal motor to maintain constant flow. Weighing is accomplished by a unique weighing system consisting of an oscillating cantilever with the filter attached. A change in mass of the filter is determined by the change in period of oscillation of the cantilever. Resolution of 1 mg over a range of 0 to 1.2 g is achieved. Field evulations have shown the PAM to give a correlation of nearly 1.0 when compared to Hi Vol samplers operated with flow regulators. The PAM is especially useful for near real time monitoring during air pollution episodes. This data can be automatically tramsmitted and logged from a remote station resulting in a faster response by authorities and at a significant savings in manpower. The PAM can run unattended for periods of up to two weeks depending upon the concentration of particulates and the selected rate of air sampling. (Author abstract)

24777 **APTIC NO. 45649**

Rowland, Ronald and Philip W. West

MICRODETERMINATION OF SULFUR BY THE RING-OVEN TECHNIQUE. *Anal. Chim. Acta, 61(6):152-155, Aug. 1972. 5 refs.*

A simple and economical method for the identification and determination of elemental sulfur through the use of the Weisz ring-oven technique is proposed. Sulfur can be collected as particulate matter on an automatic sequential tape sampler. Experiments performed show that the reagent is readily adapted to the new technique. A trace oven with accessories and a Panduz surface temperature thermometer, range +20 to 180 F, were used. The limit of detection of sulfur by the proposed method is 0.1 micrograms. The range 0.2 to 2 micrograms is recommended for optimal accuracy for quantitative work. Attempts to form rings failed when the ring oven was at 105 F. At 50 F, sulfur deposits formed on the ring, and when allowed to set for 10 minutes, it reproduced the proper color when the developing reagent was added. An 80% to 20% acetone-water mixture failed to move sulfur from the initial sample introduction site to the ring, while 100% acetone readily transported the sulfur spot to the ring, because the paper was dry. The rings formed on addition of the developing reagent changed from yellow-brown to black to a complete disappearance of color, when they were allowed to set in the dry state in air. By storing the rings in a moist condition inside a plastic Petri dish, color deterioration was greatly inhibited. The rings prepared were 22 mm in diameter. This size of ring is satisfactory when eluting materials from 0.5-inch diameter dust spots collected on a tape sampler. When the dust spots are 1 in. in diameter, 1 33-millimeter ring is recommended. The Arthur H. Thomas trace-oven attachments provided for the formation of 14-, 22-, or 33-millimeter diameter rings. Whatman No. 41 filter paper proved satisfactory, as uniform rings were produced on it, and the paper gave no blank.

24778 **APTIC NO. 46032**

Sarandria, J. L. and H. L. Weisz

AIR QUALITY CONTROL UTILIZING PHOTOMICROGRAPHIC TECHNIQUES. *Inst. of Environmental*

Sciences, Mt. Prospect, Ill., Proc. Inst. Environ. Sci. Annu. Tech. Meet., 18th, New York, 1972, p. 173-177. 6 refs. (May 1-4.)

Air quality control through pollutant monitoring is reviewed. There are 31 dust fall stations in Allegheny County for monitoring soluble and insoluble dust, and fine particulate matter is measured at 18 sampling sites. Microscopical examination of particulate matter was instituted to chemically identify the collected particles. Air quality collectors have collected over seventy reference samples. Settleable materials from the dust fall filter paper of a hi-vol sampler exhibited a unique pattern of identifiable particulate matter. Physical characterisitics are briefly described for coke spheres, coke spheres with fly ash markers, coke fragments, ash spheres, colored ash spheres, high and low temperature furnace fly ash spheres, shaly particles, irregularly shaped white particles, sulfide minerals, magnetite spheres, oxidized magnetite spheres, pulverized coal, coke breeze, coky matter from coal, P. F. fly ash, fly ash from a stoker-fired boiler, sintered agglomerates, and particulates from oil-fired boilers as combustion products and limestone, building site dust, sand quartz, brick dust, cement, road dust, and abrasives as wind erosion particulates. Slide preparation techniques are described.

24779 **APTIC NO. 46080**

Stedman, D. H., E. E. Daby, F. Stuhl, and H. Niki

ANALYSIS OF OZONE AND NITRIC OXIDE BY A CHEMILUMINESCENT METHOD IN LABORATORY AND ATMOSPHERIC STUDIES OF PHOTOCHEMICAL SMOG. *J. Air Pollution Control Assoc., 22(4):260-263, April 1972. 27 refs.*

A prototype ozone and nitric oxide monitor was used for photochemical smog studies in the laboratory and the atmosphere. The principle of the detector is based on the chemiluminescent reaction ozone + nitric oxide yields nitrogen dioxide + h upsilon. The major features are selective response to the gas being measured, sensitivity into the ppb range, linearity over a factor of 1,000,000 in concentration, and rapid (approximately 1-sec) time response. A detailed description of the detector and its calibration is given. Examples of the application of this detector include atmospheric measurements in New York, a study of 0reactions of ozone with unsaturated hydrocarbons, and a study of the thermal oxidation of NO to nitrogen dioxide are presented.

24780 **APTIC NO. 45771**

Tamori, Yukio

MEASURING METHODS OF DUST IN STACK GAS. *(Baijin no sokutei). Text in Japanese. Seikyu Gakkai-Shi (J. Japan Petroleum Inst., Tokyo), 15(7):564-568, July 1972. 50 refs.*

Measuring methods available for determining the concentration of dust in stack gas include gravimetric, optical, and Ringelmann smoke chart methods. The gravimetric method specified in standard JIS Z 8808 is described. The important procedural factors such as the equal-velocity suction for sampling, how to select the proper sampling spot, and type of dust sampler to be used are discussed with some theoretical formulas. The advantages of the tubular filter paper dust sampler over the conventional dust tube sampler include: free-size application; superb dust-arresting characteristics; low pressure loss; combined with the specially designed filter paper holder, it permits selection of a suitable nozzle according to flow velocity and capacity of the suction pump; drying time is only one hour compared with two days with the dust tube method; weighing of the filter paper only is usually enough for the measurement, thus the gross weight is about 1/10 of that indicated in the dust tube method. The basic construction and function of a cascade impactor used in analysis of particle size distribution is briefly discussed. A smokemeter is also described.

24781 **APTIC NO. 45856**

Taylor, R. D.

AN EFFICIENT HIGH-VOLUME MINIATURE AIR MOVER. *California Univ., Livermore, Lawrence Radiation Lab., Atomic Energy Commission Contract W-7405-Eng-48, Rept. UCRL-51239, TID-4500, UC-41, 8p., May 30, 1972. 4 refs.*

NTIS: UCRL-51239

A high-volume miniature air blower was developed to overcome the usual disadvantages of low-ratio of flow-rate to battery drain, high initial cost, frequent shop maintenance, and pulsating flow. It consists of a two-stage blower with backward-curved impellers powered by a commercially available motor. The entire unit can be made with low-cost, lightweight, unifrom parts that are easily assembled. Brass adapters for inlet and exit ports can be made to accommodate a variety of applications. The design and operating variables of the blower are reviewed. The blower can be used as an air mover for a portable air-sampler and as a source of pressurized, filtered air for a full-face mask respirator. Its low cost, efficiency, compactness, and toughness should permit a wide range of applications. (Author abstract modified)

24782 **APTIC NO. 45355**

Toma, Sam Z. and Samuel A. Goldberg

DIRECT INFRARED ANALYSIS OF ALPHA QUARTZ DEPOSITED ON FILTERS. *Anal. Chem., 44(2):431-432, Feb. 1972. 8 refs.*

The presence of airborne alpha quartz and other polymorphs of silicon dioxide is a health hazard of concern to all personnel working in underground mines and other dusty industries. Alpha quartz is currently monitored by filtering the dust from a given volume of air and analyzing the alpha quartz content of the dust collected on membrane filters. The feasibility of determining the alpha quartz content of the dust directly on the filter by transmission infrared spectrometry was investigated. The first requirement of such an analysis is a filter that would transmit some of the incident infrared beam energy in the region of the spectrum where alpha quartz has an absorption band suitable for quantitative analysis. Several filters were examined to determine the variation in absorbance of different portions of a single filter.

24783 **APTIC NO. 45432**

Wood, R. A., R. B. Dennis, and J. W. Smith

SPECTROSCOPY BETWEEN 5 AND 6 MICRON WITH A TUNABLE SPIN-FLIP RAMAN SOURCE. *Opt. Commun., 4(6):383-387, Feb./March 1972. 18 refs.*

The application of a tunable, infrared, spin-flip Raman source to the measurement of the absorption spectra of gases in the spectral region 5-6 micron is described. Continuous tuning was obtained by using a low finesse Raman crystal cavity to eliminate mode pulling and hopping effects. The effects of atmospheric absorption, and pulse-to-pulse and magnetic field dependent intensity variations were cancelled by using a double beam arrangement. The P and Q branch absorption spectra of nitric oxide at various gas pressures were obtained in the spectral region 1890-1835/cm. Studies at low gas pressure and with the tunable source operating close to the threshold for stimulated emission show a resolution of about 0.08/cm, determined by the linewidth of the Raman scattered radiation. This linewidth is in agreement with a mechanism of stimulated super-radiant narrowing of the spontaneously scattered lineshape. (Author abstract modified)

24784 **APTIC NO. 46272**

Yamate, Noboru

THE MEASUREMENT METHOD FOR AIR POLLUTANTS CREATED BY PHOTOCHEMICAL REACTIONS AND PROBLEMS. *(Kokagaku hanno ni yoru* *taiki osen kanren seibun no sokuteiho no genzo to mondaiten). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 71-84. 16 refs.*

Measurement methods for nitrogen oxides, hydrocarbons, and aldehydes are discussed. The Saltzman method, which uses a color generating absorbent to react with nitrogen dioxide, is widely used despite the fact that problems exist with the NO2 absorption efficiency and with nitric oxide oxidation efficiency. The Environmental Protection Agency (EPA) method, which is the standard NO2 measuring method, uses sodium hydroxide as the absorbent and coupling agent for color formation. The quantitative analysis is easily interfered with by sulfur dioxide. However, it can be eliminated by the addition of hydrogen peroxide. Gas chromatography with a flame ionization detector is usually used for the separation and identification of hydrocarbons due to its accuracy to 2% at low concentration. Aldehydes exist in the exhaust gas as formaldehyde and acrolein. A spectrophotometric method and gas chromatography are the common methods for their detection.

24785 **APTIC NO. 46376**

Yanagisawa, Saburo

EXAMINATION OF OXIDANT COMPOSITION AND MEASUREMENT TECHNIQUES. *(Okishitanto seibun no kosatsu to sokutei gijutsu). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 49-61. 21 refs.*

Methods for the measurement of oxidants are described. The potassium iodide method can be used for measurement of ozone, acetic acid, hydroperoxides, nitrogen dioxide, nitric oxide, and peroxacetyl nitrate. The ion is oxidized to I3 which is detected by titration or photometry. The ferrous thiocyanate colorimetric method can be used for the same purpose to a concentration of 1 ppb and has less interference from NO2 and sulfur dioxide. The titanium sulfate method can only be used for the measurements of O3 and tert-butyl hydroperoxide in which a titanium oxide sulfate complex is formed and determined by the photometric method. Other methods including the Saltzman method, ultraviolet spectrophotometric method, chemiluminescent method, 1,2-di-(4-pyridyl)-ethylene method, infrared photometric method, gas chromatographic method, and methods utilizing radioactive substances are also briefly described.

1971

24786 **APTIC NO. 45361**

Ghosh, A. K. and N. N. Banerjee

HYDROGEN SULPHIDE - ITS HAZARDS AND A NEW DETECTOR TUBE FOR ITS SPOT ESTIMATION. *Res. Ind. (New Delhi), 16(4):275-278, Dec., 1971. 10 refs.*

Hydrogen sulfide is one of the most toxic gases encountered in industry. It is likely to occur in almost all industrial processes where sulfur or sulfur compounds are used. The gas is very poisonous, highly flammable, and irritating to the eyes. The functions of the respiratory enzymes are paralyzed through inhalation of the gas, and the internal vesicular respiration is inhibited. One part per 1000 volumes can cause immediate unconsciousness; 50 ppm by volume can cause poisoning. The maximum allowable concentration of the gas is 20 ppm by volume, and the threshold value is 10 ppm by volume. Existing methods of spot detection of hydrogen sulfide are discussed, including lead acetate test papers and detector tubes. A new detector tube uses bismuth nitrate as the reacting chemical along with specially treated silica gel as the granular material. Because of its low solubility, bismuth sulfide has a high sensitivity for detection. Controlled deactivation of the purified gel facilitates linear spreading of coloration. A color indicates the presence of hydrogen sulfide in the sample. The length of the colored gel is measured, and the hydrogen sulfide content is estimated by comparison against the extent of spread obtained with a standard mixture of the gas in air. The procedure for preparation of the tube and economics of production are reviewed.

24787 **APTIC NO. 45348**

Linch, Adrian L. and Herman V. Pfaff

CARBON MONOXIDE--EVALUATION OF EXPOSURE POTENTIAL BY PERSONNEL MONITOR SURVEYS. *Am. Ind. Hyg. Assoc. J., 32(11):745-752, Nov. 1971. 20 refs.*

Fixed station monitors located in a large consolidated warehouse in which gasoline-powered lift trucks are operated disclosed peak concentrations of carbon monoxide in the range of or above the 1970 threshold limit value of 50 ppm. To determine whether employees assigned to this area are exposed to excessive CO concentrations, personnel monitoring surveys were proposed. Attempts to adapt the liquid reagents reported in the literature to the system developed for tetraalkyl lead exposure control met with failure. A manufacturer of length-of-stain detector tubes indicated that the CO tube would provide 4-hour continuous sampling. Recalibration at a rate of 8 ml/min confirmed this report for a range of 30-60 ppm. Flow rate and oxygen concentration are the controlling variables. Surveys carried out in either warm or cold-weather conditions disclosed no exposure conditions which approached the limit of 50 ppm on an 8-hour average basis. (Author abstract)

AIR QUALITY MEASUREMENTS

1972

24788 **APTIC NO. 45669**

THE DUST CONCENTRATION OF THE AIR. *(Staubgehalt der Luft). Text in German. Naturw. Rundschau, 25(8):315-316, Aug. 1972.*

The measurement of atmospheric dust concentrations has become feasible through the use of filter bands where the dust is collected. The dust quantity can be determined from the weight increase of the filter band. A recently developed monitor that operates according to this principle was tested in the water purification plant Jungfernheide. The sampling opening was about 5 meters above ground. An industrial area, an electronics device manufacturing plant, and open countryside were in the vicinity. For comparison measurements were also taken 10 km away in a residential area of Berlin-Dahlem. At the measurement station Jungfernheide, more than 2700 three-hour average values were obtained within 1 yr. The down-time was 7%. In Berlin-Dahlem, the down-time was only 3%. Most of the measured dust concentrations at the Jungfernheide station (district Charlottenburg, West Berlin) were 0.06mg-0.10mg dust/cu m. Only a small number of values exceeded the limit of 0.2 mg. In Berlin-Dahlen, the dust concentrations were much lower. The highest dust concentrations were measured at both stations during the winter months in the late morning hours. The concentrations fell off during weekends.

24789 **APTIC NO. 45969**

Resources Research, Inc., Washington, D. C.

ACCIDENTAL EPISODE MANUAL. *Office of Air Programs Contract 68-02-0029, APTD-1114, 251p., Jan. 1972. 51 refs.*

NTIS: PB 210814

A need has been expressed for a manual to spell out in simple and direct language what the air pollution control agency can or ought to do during an episode to help minimize its impact on the people and economic life of the community. As currently viewed, the legitimate role of the agency in accidental episodes is that of support through its capabilities in air quality surveillance and estimate of hazard area. The manual focuses upon the agency role in these areas. Chemical detection kits and other equipment with chemical analysis procedures, hazard area estimates, including the prediction model, toxicity factor, hazard area templates, source strength considerations, wind speed considerations, and adjustments for fire and terrain are involved. A contingency plan for community action involves legal authority, alert stages, emergency operations center, support documentation, check lists; contingency plan implementation and organization; standard operating procedures in implementing the contingency plan, which includes the different alert stages; and communications. Among other items in the manual are case histories and statistics of accidental episodes and safety aids. The air pollution prediction model is presented.

24790 **APTIC NO. 45756**

Blanco, A. J. and R. G. McIntyre

AN INFRA-RED SPECTROSCOPIC VIEW OF ATMOSPHERIC PARTICULATES OVER EL PASO, TEXAS. *Atmos. Environ., 6(8):557-564, Aug. 1972. 4 refs.*

A microspectrophotometric monitoring technique was used to obtain full scale, high resolution infrared absorption spectra from impactor samples of atmospheric dust taken over industrial, commercial, and residential areas within the metropolitan area of El Paso, Texas. The sampling, preparation, and analytical techniques are examined. The constituents determined included silicates (quartz, kaolinite, montmorillonite, and illite), carbonates (calcite and dolomite), hydrocarbons, nitrates (potassium and sodium), and sulfates (ammonium, mirabilite, thenardite, and gypsum). The composition and transition of composition of the particulates were surprisingly close to those of similarly fractionated samples from an isolated mountainous site 120 km to the northeast of El Paso. The composition data illustrated a transition from a silicate and carbonate dominated giant particle fraction (greater than 2.0 micron) to an ammonium sulfate dominated large particle fraction (within 0.3-2.0 micron). (Author abstract modified)

24791 **APTIC NO. 46113**

Bourbon, P. A. Lemoine, J. Breuillaud, G. Michel, J. Olle, R. Malbosc, M. Giroux, R. Nivot, and M. Pellegrin

BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS. *(Etude sur la pollution bacteriologique et chimique de l air a Toulouse: Methode de prelevement et premiers resultats). Text in French. Tribune CEBEDEAU (Centre Belge Etude Doc. Eaux), no. 343-344:325-328, June- July 1972. 9 refs.*

Bacteriological and chemical air pollution studies performed in Toulouse during the 6-month-period in 1971 are described. The samplings for bacteriological investigations were done by means of bubbler at 1.50 m height, and the enumeration was performed after a 72-hour-incubation. The total count of microorganisms, ranging from 440 to 5600/cu m, showed seasonal variations (increase during fall). No correlation between bacteriological and chemical pollution levels was established. Alternate predominance of bacteria and fungi was observed. The fungi count in warm and even windy weather showed a falling trend. Constant dominance of gram-positive catalase-positive bacilli and cocci was determined. Bacilli accounted for 45-65% of the total bacteria count with B. cereus, B. subtilis, and B. megatherium totaling 95%. Micrococcaceae were present in a proportion of 9-49% with a dominance of micrococci. The proportion of Corynebacterium ranged from 2 to 23%, and Pseudomanas, Achromobacter, and Acinetobacter were also found; no pathogenic germs were detected. The sulfur dioxide, sulfur trioxide, nitric oxide, and nitrogen dioxide concentrations were 0-79, 3.7-39, 90, and 30 gamma/cu m, respectively.

24792 **APTIC NO. 46074**

Hoeft, R. G., D. R. Keeney, and L. M. Walsh

NITROGEN AND SULFUR IN PRECIPITATION AND SULFUR DIOXIDE IN THE ATMOSPHERE IN WISCONSIN. *J. Environ. Quality, 1(2):203-208, 1972. 25 refs. (Presented at the Soil Science Society of America Meeting, Tucson, Ariz., Aug. 26, 1970.)*

The seasonal distribution of sulfur and nitrogen from the atmosphere was monitored in the ambient air and in samples of precipitation throughout Wisconsin, and the related absorption of atmospheric sulfur dioxide by alfalfa was evaluated. Atmospheric SO2 levels at all rural and urban locations were low in the summer months and increased markedly in the winter months; on the average, the values in urban areas were about twice those in rural areas. The SO2 values at 2 km from an industrial location were 10-15 times as high as the values at urban locations; at 5 km, the values were comparable to those at urban areas and at 10 km, to those at rural areas. Sulfur (as sulfate) in precipitation followed the same seasonal and location trends at SO2, with sulfur values of 16, 42, and 168 kg/ha/yr for rural, urban, and industrial areas, respectively. The overall state average was estimated at 30 kg/ha/yr. Sulfur-deficient alfalfa plants grown in a greenhouse obtained as much as 73% of their sulfur from the atmosphere. The amount of nitrogen (ammonium, nitrate, and organic nitrogen compounds) deposited by precipitation was highest during the spring months and lowest during the winter months. Both NH4-N and organic nitrogen levels were higher in areas adjacent in barnyards than in areas further removed. However, NO3-N deposition was relatively constant for all locations and was slightly lower in the winter. Total N additions ranged within 13-30 kg/ha/yr, with an estimated overall state average of 20 kg/ha/yr. (Author abstract modified)

24793 **APTIC NO. 46359**

Kirsch, H.

EMISSION MEASUREMENTS OF HYDROGEN CHLORIDE IN THE VICINITY OF POTASSIUM PLANTS. *(Immissionsmessungen von Chlorwasserstoff im Einwirkungsbereich von Kaliwerken). Text in German. Z. Ges. Hyg. Ihre Grenzgebiete (Berlin), 18(8):585-586, Aug. 1972. 6 refs.*

In the vicinity of five potassium plants, emission measurements were taken. The hydrogen chloride in the air was washed out in an impinger with 30 ml 0.01 n sodium hydroxide. The sampling speed was 30 l/min. The extinction was measured at 460 nm. The Spekol (VEB Carl Zeiss Jena) was used for measurements taken at a mobile station driven to distances between 300 and 2000 m of the plants. The measurements were always taken on the windward side. The average of all 94 measurements was 5.22 mg/cu m. The maximum concentration was 17.10 mg/cu m, the minimum concentration 1.07 mg/cu m. At a distance of 2000 m, 1.57 mg/cu m were measured. The maximum allowable emission concentration of 0.05 mg/cu m was exceeded. Scrubbers were installed in the stack at two plants. The concentration in the vicinity of these plants was on the average 6.65 mg/cu m, thus the scrubbers operated unsatisfactorily.

24794 **APTIC NO. 45353**

Kiseleva, M. S., G. Ye. Sinel nikova, and Ye. O. Fedorova

AMMONIA INFRARED SPECTRA IN ATMOSPHERE. *(Infrakrasnyye spektry ammiaka v atmosfere). Text in Russian. Izv. Akad. Nauk SSR, Fiz. Atmosfery i Okeana, 8(3):333, March 1972.*

Two new absorption bands of 3.01 and 2.25 micron with a bandwidth of 0.02 micron were determined by means of automatic stratostat-borne spectrometers at altitudes up to 30 km and directions close to the geometrical horizon. Traces of the 2.25 micron-band were also detected by land-based instruments. The apparent similarity of the 3.01 and 2.25 micron-spectral bands with bands obtained for mixtures of air with small amounts of ammonia by means of the same instruments indicates that the above spectra may well be those of ammonia.

24795 **APTIC NO. 45595**

Mongan, T. R.

FEDERAL AIR QUALITY DATA COLLECTION IN THE UNITED STATES. *Clean Air, 6(2):23-25, May 1972. 3 refs.*

The National Aerometric Data Information Service was established by the Environmental Protection Agency to collect and store all air quality data gathered by governmental agencies in the United States. Some difficulties in the developing of NADIS arose from flaws in the conceptual design of the system. The actual needs for the data which the system was to accumulate were not clearly identified at the outset. Too much data was gathered and the data base was of uneven quality. The computerized data bank concept was too grandiose. Suggestions are made to the designers of large or small environmental data collection systems which will help them to avoid the problems encountered by NADIS. (Author abstract modified)

24796 **APTIC NO. 45661**

Pasternak, N. I. and V. G. Brysin

ON THE CONCENTRATIONS OF ALLERGENIC POLLENS AND MOLDS IN THE ATMOSPHERE. *(O soderzhanii pyl tsevykh i gribkovykh allergenov v atmosfernom vozdukhe). Text in Russian. Gigiena i Sanit., 37(16):97-98, 1972. 6 refs.*

Results of investigations of allergenic pollen and mold concentrations in the air, performed in the Uzbek SSR during the Feb. 20-Oct. 1 periods of 1966-1970 are presented. The pollen concentrations had three distinct yearly maxima, according to the composition and the activity of the vegetation. Pollens of poplar, willow, maple, and ash were predominant during the first late February-early March peak of 600/cu cm. Pollens of acacia, nut, mulberry, plane, cereals, and malvaceae prevailed during the second maximum of 1200-1400 cu cm from late April through mid-June. The highest maximum with 2000 cu cm during Aug.-Sept. was primarily due to wormwood. No differences in the concentrations between urban and rural areas were observed. Molds, identified as yeast, Penicillium, Alternaria, Cladosporium, Aspergillus fum., Aspergillus nig., Aspergillus or., Aspergillus flavus, Rhizopus nig., Stachibotris alt., Fusarium, Actinomyces, Mucor, Acromoniella, Mycetie steril., Cephalosporium, Rhodotorulla, Trichotecium, and Phoma were present throughout in fairly high concentrations. The mold concentrations were lowest (172+ or -11/cu m) during late March through early April, probably due to substantial precipitation. They increased during May and decreased during July-August, probably due to low humidity and high temperatures. High levels of 3100+ or -171/cu m occurred during the Sept.-Nov. periods. Cladosporium was found in the highest proportions, and Alternaria, Aspergillus, Penicillium, Actinomyces, and yeast were encountered frequently. Fusarium, Mucelia, Acromoniella, Mucor, and Rhezopus were found sporadically. Distinct seasonal variations in the concentrations of many species were determined. The total amount of pollens and molds was highest during the Aug.-Nov. periods.

24797 **APTIC NO. 45718**

Suzuki, Masashi

ENVIRONMENTAL CONCENTRATION OF TOXIC MATTERS AND INDIVIDUAL EXPOSURE CONCENTRATION. *(Yugaibutsu no kukichu kankyo nodo to kojin hibaku nodo). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 14(4):400, July 1972.*

The relation between individual exposure concentrations and environmental concentrations was studied at atomic power plants. Generally, the former is estimated from the latter. At an integrated uranium refinery with large spaces and adequate ventilation, the individual exposure concentration and environmental concentrations measured at several locations were of the same order and fairly consistent. At a uranium metal refinery, where dust sources were concentrated, the individual exposure concentration was as much as 10 times higher than the environmental concentration.

1971

24798 **APTIC NO. 45632**

Samedov, I. G. and A. S. Kurbanov

POLLUTION OF THE AIR WITH CARCINOGENIC SUBSTANCES BY BAKU PETROLEUM REFINERIES. *(K voprosu zagryazneniya kantserogennymi veshchestvami atmosfernogo vozdukha neftepererabatyvayushchikh zavodov gor. Baku). Text in Russian. Azerb. Med. Zh., 28(11):62-67, 1971. 9 refs.*

Spectrographic analyses of air samples (350 to 400 cu m) collected at various areas of a Baku refinery (distillation (21), pyrolysis (16), asphalt production (11), coking (9), and petroleum products purification sections (15) revealed that their 3,4-benzoperylene (I) and 1,12-benzoperylene (II) concentrations measured at 4030 and 4078 A, respectively, varied widely with the operation. Concentrations of I and II in the air were lowest in the distillation operation at approximately 0.015 and 0.11 micrograms/100 cu m, and were highest at 45 to 72 and 19.4 to 35.8 micrograms/100 cu m during the discharge of coke from the still. Hermetization, mechanization, automation, and the planting of trees are recommended as means for reducing the discharge of carcinogenic chemicals into the atmosphere.

ATMOSPHERIC INTERACTION

1972

24799 **APTIC NO. 46354**

Ahrens, D.

THE DEPENDENCE OF WIND PROFILES ON THE WEATHER CONDITION. *(Abhaebgigkeit des Windprofils von der Wetterlage). Text in German. Meteorol. Rdsch., 25(4):116-126, 1972. 19 refs.*

The vertical wind profile in the plains of the upper Rhine depend on the atmospheric condition. Measurements were made in Karlsruhe with the intention of simplifying the calculation of pollutant dispersion in this area. During 2 years, the wind velocity was measured at six altitudes between 20 and 160 m. The wind profile was determined by computing quotients of the velocity in different steps of height. It is a function of the stability classes computed from measurements of radiation, wind velocity, synoptical data, and gustiness. During changeable and stable stratification there is a clear connection between stratification and wind profile, but not during inversions. Profiles of shearing stress and fraction velocity are computed from the same measurements by assuming isotropical turbulence; they strongly depend on height and atmospheric stratification.

24800 **APTIC NO. 45750**

Burkitt, A., P. Lester, and G. Nickless

DISTRIBUTION OF HEAVY METALS IN THE VICINITY OF AN INDUSTRIAL COMPLEX. *Nature (London), 238(5363):327-328, Aug. 11, 1972. 3 refs.*

The concentrations of lead, cadmium, and zinc in samples of grass, moss, and lichen in the vicinity of an industrial complex were measured to determine the geographic distribution of heavy metals and the estimated contribution from the smelters in the area. Metal contents in the samples were analyzed using an atomic absorption spectrophotometer. Very high concentrations of the metals were determined in the samples near the smelters along both the A and B transects, at 46 and 60 deg T from Avonmouth, respectively. Concentrations decreased with increasing distance from the plants, but significant quantities were still detected 7 miles away. Both transects are within the zone of prevailing winds. Concentrations along transect C, to the north of Bristol, increased as the sampling line moved into the zone of the prevailing wind from Avonmouth, supporting the case of airborne pollution.

24801 **APTIC NO. 46014**

Byzova, N. L.

METHOD OF EVALUATING ATMOSPHERIC DIFFUSION FROM TURBULENT CHARACTERISTICS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 46-63. 17 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 179-193.)*

NTIS: PB 210653

The pollutant distribution in a turbulent atmosphere is discussed with the help of Lagrangian method. Approximate connection between Lagrangian and Eulerian turbulent characteristics is used for evaluation of turbulent diffusion parameters. The diffusion parameter estimations for boundary air layer are given. A comparison with semi-empirical methods of pollutant distribution calculation is presented. This method allows consideration of some specific problems, in particular, evaluation of the influence of gravitational sedimentation on diffusion parameters taking into account correlation loss because of particle displacement in the process of vertical motion; and derivation of formulas for dispersion calculation of diffusible pollutants from a point source of finite operation time. The statistical method makes it possible to calculate the diffusion characteristics of a plume directly from the turbulent characteristics, without using the diffusion equation.

24802 **APTIC NO. 45393**

Chen, Wen-Yuan

ON THE APPLICATION OF RICE S EXCEEDANCE STATISTICS TO ATMOSPHERIC TURBULENCE. *Preprint, American Inst. of Aeronautics and Astronautics, New York, 5p., 1972. 9 refs. (Presented at the American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 10th, San Diego, Calif., Jan. 17-19, 1972, Paper 72-136.)*

Atmospheric turbulence not only affects the structure and handling of aircraft, but also poses a problem in such areas as communications and weather forecasting. To construct a sound model for successful scientific predictions, it is necessary to know the form of first and higher-order probabilistic structures. It has been known for some time that atmospheric turbulence is in general nonstationary, and that variations in variances cause the distribution to become non-Gaussian. It is now indicated that even for a stationary segment of turbulence, the process is still highly non-Gaussian, in spite of the Gaussian appearance of the first-order distribution. The atmospheric boundary layer data of the Barbados Oceanographic and Meteorological Experiment (BOMEX) and the turbulence generated by a well-controlled laboratory tunnel, although having excellent stationary characteristics over a very long record and exhibiting excellent normal first-order distributions, also indicate strongly non-Gaussian second-order distributions. Even stationary atmospheric turbulence with a normal first-order distribution cannot be considered a Gaussian process; consequently, the application of Rice s exceedance statistics to atmospheric turbulence should be approached with caution. (Author conclusions modified)

24803 **APTIC NO. 46015**

Garger, Ye. K.

SCATTERING OF SMOKE FROM A HIGH-LEVEL POINT SOURCE. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 64-76. 12 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 194-206.)*

NTIS: PB 210653

Measurements of smoke plume dispersion in a horizontal plane were carried out from an elevated point source situated at a height of 300 m. A photogrammetric method of smoke plume fixing was used. The values of pollutant dispersion for instantaneous and averaged smoke plume and of dispersion of axis ordinates for instantaneous plumes were determined. Velocity of turbulent energy dissipation, Lagrangian time scale, and coefficients of turbulent mixing in the crosswind direction were estimated on the basis of the diffusive experimental data. The results were compared with analogous parameters received from structural measurements fulfilled at the same time with measurements of smoke plume dispersion.

24804 **APTIC NO. 45459**

Ghose, S. K.

METEOROLOGY AND OUR ENVIRONMENT. *Pesticides (Bombay), 6(4):29-31, April 1972.*

The present tendency towards industrial expansion which is prevalent throughout the world is leading to an increase of air pollution. Carbon dioxide, motor vehicle exhaust gas, combustion gases, and sulfur compounds are cited as leading to increases in temperature, photochemical smog, increases in precipitation, and heat pockets. The dispersion of pollutants is mentioned, including stability and inversion conditions. For a better understanding of the causes and consequences of air pollution, the World Meteorological Organization has recommended the establishment of a network of stations to study atmospheric pollution. The India Meteorological Department which is actively participating in this project has been measuring the turbidity of the atmosphere at 15 stations in various parts of the country for the last 10 years. Excerpts are presented from the inaugural address by B. C. Haldar, Director of the Institute of Science in Bombay, at the Symposium on Environment held at the Institute on March 17, 1972. The necessity of realizing that the environment is not merely a collection of isolated areas, but consists of mutually interacting systems integrated into a complex pattern, is pointed out. Training scientific manpower for research on environmental problems is mentioned.

24805 **APTIC NO. 46012**

Gorlin, S. M., I. M. Zrazhevskiy, and S. P. Ziborova

STUDY OF THE INFLUENCE OF IRREGULARITIES OF THE EARTH S SURFACE ON THE AIR FLOW CHARACTERISTICS IN A WIND TUNNEL. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 18-32. 6 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 147-161.)*

NTIS: PB 210653

In the case, when characteristic turbulence scale is of the order of the size of the studied obstacle, the effect of upstream turbulence intensity is substantial. The character of the effect depends on the form of the body and considerably influences current pattern over complex obstacles. The increase of intensity of turbulence leads to more monotonous velocity distribution and to the increase of turbulized zone. The change of Reynolds number does not influence the whole current structure in rather large range, except the thin layer directly adjacent to the obstacle. The velocity field and intensity of the longitudinal turbulence component over flat hills with different slopes and shapes, hollows, three-dimensional hills, two types of residential buildings and some other obstacles were studied. The change of turbulence intensity in the region of a hill model with a slope up to 16 deg is not very large. A decrease of turbulence intensity was observed in the regions of flow convergence, i.e., in the front part of the hill, and more substantial increase is found in its back part. Velocity braking behind the hill with a slope of 12 deg reached 50% from upstream velocity and included the region equal to half the height of the model. Turbulence intensity over a residential building model increases sharply. Eddy zone has rectilinear boundary with a large slope up to 6-7 deg. The angle of slope of this boundary depends on ratio of mean building height and characteristic turbulence scale. The obtained results and observational data in natural conditions are in good agreement.

24806 **APTIC NO. 46019**

Goroshko, B. B. and E. N. Zashukhin

EXPERIMENTAL STUDIES OF ATMOSPHERIC POLLUTION IN INDUSTRIAL AREAS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 98-108. 57 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 227-237.)*

NTIS: PB 210653

Air quality measurements were carried out in different seasons and in different climatic zones, taking into account diurnal variations of meteorological elements. The observations included: measurements of temperature, humidity, wind velocity up to 17 km, and thermal balance and observations of wind direction variations; aerological observations of meteorological element distribution with the height using a captive balloon up to 500 m and an aircraft and/or helicopter up to 1000 m; sampling under the plume simultaneously at about 20 points at 10-20 km distances from the source; and measurements of emission parameters--a total volume of effluent gases, the quantity of noxious substances for each ingredient emitted into the atmosphere, and the temperature of the effluent gases. Lowest concentrations of sulfur dioxide were observed during the morning periods. On passing to daytime conditions, the zone of concentrations above the maximum permissible norm quadrupled. During the evening period, a decrease of the concentrations was observed at all distances. In the presence of an isothermal or inversion distribution of temperature, the surface concentrations of SO2 decreased substantially. On passing from winter to summer conditions, a general increase in concentration and a 1.5-fold expansion of the range of influences of the source took place. Minimum SO2 concentrations were observed at a wind velocity up to 2 m/sec. The magnitude of the concentration in the surface layer strongly depended on the turbulence coefficient; the lower the coefficient, the smaller the SO2 concentration near the ground. Turbulence coefficients were calculated from lapse-rate observation data. The data obtained were distributed over three gradations: 0-0.10, 0.11-0.20., and 0.21-0.3 sq m/sec. For the first gradation, the concentration maximum was approximately 1/2 of the second, and 1/3 of the third. As the turbulence coefficient increased, so did the zone of high concentrations. An example of the distribution of carbon monoxide concentrations in a plume from a metallurgical complex and temperature profiles bases on radiosonde data are presented.

24807 **APTIC NO. 46039**

Hales, Jeremy M.

SCAVENGING OF GASEOUS TRITIUM COMPOUNDS BY RAIN. *Battelle Memorial Inst., Richland, Wash., Atmospheric Sciences Dept., Atomic Energy Commission Contract AT(45-1)-1830, Rept. BNWL-1659, UC-53, 43p., April 1972. 14 refs.*

NTIS: BNWL-1659

Washout of gaseous tritium compounds from the atmosphere was investigated theoretically based upon the reversible gas-washout theory including parameters of desorption and the influence of liquid-phase transport. General equations based upon assumptions of vertical rainfall, spherical noninteracting drops, and linearity of the mass-transport processes, are presented to describe pollutant concentrations in single drops as they fall through the atmosphere. Results from these equations may be combined to provide total washout characteristics for natural rain by simple distribution over the drop-size spectra and should be applicable for washout of all gases depending upon their deviations from this idealized behavior. The isotopic hydrogen gases, HT and T2, and the isotopic waters, HTO and T2O, were of primary interest. Sample caclulations are presented for a specific rain situation in conjunction with bivariate, normally distributed plumes containing HT and HTO; HTO was washed out much more rapidly than HT due to the low solubility of the latter. Stack height played a rather prominent role in affecting washout, especially at distances close to the source. Fog formation was important in affecting HTO washout but an insignificant influence insofar as HT was concerned. (Author abstract modified)

24808 **APTIC NO. 45950**

Hanna, Steven R.

DESCRIPTION OF ATDL COMPUTER MODEL FOR DISPERSION FROM MULTIPLE SOURCES. *National Oceanic and ATmospheric Administration, Oak ridge, Tenn., Air Resources Atmospheric Turbulence and Diffusion Lab., Rept. ATDL-56, 14p., April 1972. 7 refs. (Presented at the Industrial Air Pollution Control Conference, Annual, 2nd, Knoxville, Tenn., April 20-21, 1972.)*

The ATDL computer model for dispersion from multiple sources is reviewed with respect to basic theory, the Firtran IV program, required input data, and example of application. In order to estimate surface concentrations of pollutants in regions containing many sources, it is convenient to place the emissions in two categories: area sources home heating and small industries) and point sources (power plants and large industries). This model has been successfully applied to many regions, including Rockwood-Harriman, Tennessee and Knoxville, Tennessee. The input parameters include source strength and height, stability classes, wind speed and direction, and plume behavior.

24809 **APTIC NO. 46096**

Huang, Chao-Ming, Jesse H. Coleman, Thomas L. Montgomery, and Francis E. Gartrell

ATMOSPHERIC CHEMICAL INTERACTIONS IN COAL-FIRED POWER PLANT PLUMES. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 22p., 1972. 30 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-70.)*

A three-phase plan for studying the chemical interactions in power plant plumes, including instrument needs and study methods, is described. The three phases include full-scale field studies for determining the plume particle size distribution and the relative dispersion of sulfur dioxide and particulates;

evaluating the surface concentrations of plume constituents with respect to plant operations, meteorological conditions, and travel time of plume; and evaluating the chemical interactions in power plant plumes. Results of phase one are presented. This phase involved field sampling at the Tennessee Valley Authority s Bull Run Steam Plant, where data were obtained by an instrumented helicopter in conjunction with a supporting ground station. The results suggest an appreciable effect of gravity on the settling of particulates 5 micron or larger in diameter. The particle size distributions are still being analyzed. A mobile monitoring van is being utilized to measure the relative concentations of sulfur dioxide, nitrogen dioxide, and ozone at TVA coal-fired power plants. These data will be compared to plant operations, meteorological conditions, a plume travel time. A kinetic model will be developed to account for the rates of change of the concentrations of various plume components as a result of their chemical interactions and the effect of meteorological conditions upon these reactions. This model will consider such chemical species and meteorological factors such as sulfur dioxide, nitric oxide, nitrogen dioxide, ozone, carbon monoxide, unsaturated hydrocarbons, particulates, atmospheric dispersion, solar radiation, ambient temperature, and humidity. (Author summary modified)

24810 **APTIC NO. 45402**

Ikeda, Yuko, Masakatsu Hiraoka, and Hiroaki Todaka

PREDICTION OF URBAN SCALE AIR POLLUTION. *(Daitoshi no heikin taiki osen nodo yosoku ni kansuru kenkyu). Text in Japanese. Doboku Gakkai Ronbun Shu (Trans. Japan Soc. Civil Eng.), no. 204:31-38, Aug. 1972. 9 refs.*

Two methods for the prediction of pollutant concentrations were applied to a large scale diffusion model for the Osaka area. In the first method, atmospheric pressure distribution was classified into several patterns and the parameters which represented the categories were used for the prediction. In the second method, the parameters used for prediction were obtained by measuring wind direction, wind velocity, solar radiation, and the amount of cloud. For the first method, the plot of predicted concentration of sulfur oxides vs. the observed value revealed that the probability of accurate prediction of concentrations higher than 0.05 ppm/day was 0.591; that for concentration higher than 0.06 ppm was 0.773. For the second method, the probabilities were 0.765 and 0.778, respectively.

24811 **APTIC NO. 46273**

Ito, Kyogi

ASCENDING AND DESCENDING CURRENTS RELATED TO PHOTOCHEMICAL SMOG PHENOMENA. *(Kokagaku sumoggu gensho ni kankeisuru josho kako kiryu ni tsuite). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 95-99. 5 refs.*

Ascending and descending currents of air and their relations to photochemical smog are described. The convection phenomenon of the atmospheric layer in the convection cycle has a close relationship with meteorological conditions. During low pressure, including tropical storms, the ascending current predominates and the weather is bad, whereas with high pressure the descending current predominates and the sky is clear. Ascending currents also exist in the trough of atmospheric pressure, cold wind, and warm wind front. The measurements of these currents are briefly described.

24812 **APTIC NO. 46013**

Ivanov, V. I.

USE OF PARAMETERS OF EULERIAN TURBULENCE FOR ESTIMATES OF LAGRANGIAN CHARACTERISTICS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 33-48. 15 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, 162-178.)*

NTIS: PB 210653

An evaluation method of Lagrangian turbulence characteristics necessary for pollutant diffusion calculation based on similarity theory is suggested and the Eulerian turbulence parameters are used. Though this method is approximate, the calculations of specific cases are carried out with exactness sufficient for practice. Calculations performed on observed data from a 300 m mast showed the possibility of detailed calculation of the thermal stratification effect on turbulent diffusion parameters. Vertical profiles of Lagrangian characteristic values of time and length, dissipation of turbulent energy, and horizontal components of turbulent diffusion coefficient for different stratification conditions are obtained.

24813 **APTIC NO. 45391**

Kaplan, Michael L. and Douglas A. Paine

A MACROSCALE - MESOSCALE NUMERICAL MODEL OF INTENSE BAROCLINIC DEVELOPMENT. *Preprint, American Meteorological Society, Boston, Mass., 50p., 1972. 20 refs. (Presented at the International Conference on Aerospace and Aeronautical Meteorology, Washington, D. C., May 22-26, 1972.)*

A numerical model was designed to link quasi-geostrophic and mesoscale forcing. Initializations performed at 127 km with either a barotropic forecast or a diagnostic omega equation are followed by a prediction with a moist nine-level primitive equation model operating on a 32 km grid mesh. The results of two short-period integrations indicate good correspondence between forecast omega fields and radar observations, observed snowfall, and diagnostic integrations. Vertical motions reach maxima of 25 and 50 cm/sec, while the forecast dependent variables indicate an integral role played by long gravity waves in organizing mesoscale development.

24814 **APTIC NO. 45639**

Kasuya, Mitsuo, Shigeru Sugiura, and Takeshi Kawamura

LOCAL WEATHER ANALYSIS OF TOKYO AND THE VICINITY PHOTOCHEMICAL SMOGS. *(Tokyo oyobi sono shuhen chiiki ni okeru kokagaku sumoggu no kyokuchi kisho kaiseki). Text in Japanese. Japan Meteorological Assoc. (Japan). Proc. Symp. Japan Meteorol. Soc., Spring, 1972, 29p.*

Weather conditions in Tokyo and its vicinity at times of high oxidant concentration were analyzed. Between June 15 and October 31, 1972, 28 warnings were issued for oxidant concentrations higher than 0.15 ppm/hr; of this number, 17 warnings were issued at times when the trough or front of atmospheric pressure had passed or was passing through the area. Based on the analysis of recorded weather data, there is a clear trough of atmospheric pressure in the upper atmospheric layer when pollution covers a wide area. District differences of thermal low pressure depend on the strength of the atmospheric pressure through and the time and latitude of its passing.

24815 **APTIC NO. 45670**

Kasuya, Mitsuo, Shigeru Sugiura, and Takeshi Kawamura

GENERAL WEATHER CONDITIONS FOR THE FORMATION OF PHOTOCHEMICAL SMOGS IN TOKYO AND THE VICINITY. *(Tokyo ni okeru kokagaku summogu hassei no sokan kisho joken). Text in Japanese. Japan Meteorological Assoc. (Japan), Proc. Symp. Japan Meteorol. Soc., Spring 1972, p. 29.*

Weather conditions in the Tokyo area during photochemical smog formation were analyzed using data from 1967-1971. Photochemical smog occurred mainly in summer months, at temperature higher than 24 C, wind velocity lower than 4 mi/sec, humidity at 60-80% for more than 9 hr, and in the presence of sea breezes. The visibility was less than 3 km. In 1971, there were 24 instances of high oxidant concentration, and the areas of high concentration corresponded to the movement of the sea wind front. Weather conditions in the Los Angeles area are compared.

24816 **APTIC NO. 46369**

Kawamura, Takeshi

AIR POLLUTION CAUSED BY PHOTOCHEMICAL REACTION AND METEOROLOGICAL CONDITIONS. *(Kokagaku hanno ni yoru taiki osen to kisho joken). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 85-93. 15 refs.*

The air pollution by photochemical reaction and its relation to meteorological conditions in the Tokyo area are described. The major period of the smog occurrence is June to mid-August and the inverted layer is a flow type, compared to the precipitating type of Los Angeles. The photochemical smog always occurs at a temperature higher than 24 C, with wind velocity lower than 4 m/sec, humidity at 60% to 80% for more than 9 hours, and with over 3 hours of solar radiation 14 hours prior to smog occurrence. The unsolved meteorological problems concerning air pollution include the formation mechanism of the inverted layer under 1000 m, the structure of the local wind system, and the vertical motion of the atmosphere.

24817 **APTIC NO. 46017**

Mashkova, G. B.

USE OF SURFACE OBSERVATIONS FOR CHARACTERIZING THE STATE OF THE SURFACE ATMOSPHERIC LAYER. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 85-90. 4 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 215-220.)*

NTIS: PB 210653

The possibility of employment of meteorological network observations for determining the instability characteristic of the lower part of the boundary layer was studied. The comparison of stability types was carried out on Pasquill classification with instability parameter calculated on gradient observations. The frequency of different stratification types for seasons and during the day was investigated on observation data from 1967. Stratification characteristics obtainable with the aid of lapse rate observations may be justifiably extended to much longer areas when network meteorological observations are taken into account.

24818 **APTIC NO. 45357**

Mingle, John O.

ORDER-OF-SCATTERING THEORY FOR TRANSPORT PROCESSES. *J. Math. Anal. Appl., 38(1):53-60, April 1972. 6 refs.*

The buildup of the particle reflections and transmissions are followed by considering the effect of each successive scattering interaction. There are several advantages in following an order-of-scattering approach to transport theory. Some of these include the ease of repeated calculations for the same size system by just resuming the series of previously calculated values with a new scattering parameter. In addition, the scattering parameter values representing the critical system can be easily found. Another important point is that the order of scattering equations is always linear in nature while the usual invariant imbedding equations are nonlinear. In general, the accuracy of the numerical results is limited by the angular order for small sizes and by the number of orders-of-scattering included in the calculations for large-sized systems. It is possible to extend this theory to nonuniform properties. (Author conclusions modified)

24819 **APTIC NO. 46011**

Ogneva, T. A.

MICROMETEOROLOGICAL CHARACTERISTICS OF ATMOSPHERIC POLLUTION CONDITIONS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 8-17. 18 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 137-146.)*

NTIS: PB 210653

Micrometeorological characteristics which influence the pollutant dispersion in the atmosphere are described. Information on the air temperature gradient in the lower layer of 2 m, received on systematic measurement data, is cited. Its variation in annual and daily course in different geographical zones on the territory of the Soviet Union and frequencies of different values of extreme temperature gradients are shown. Close connection of gradients with radiation balance is revealed. The regularities of the turbulence coefficient variation on the height of 1 m in time and space are considered; a map of its values at 1:00 pm in July is given, from which latitudinal variations are seen, turbulence coefficient in southern regions of the country being twice as large as in northern regions. A correlation table is given which characterizes wind velocity changes in different relief forms. Wind direction stability as an index of turbulent mixing intensity is discussed. A diagram built on experimental data received in different regions is cited. Wind direction variation increases with instability growth and decreases with wind velocity increasing. Some data on variation of air temperature regime under the effect of urban regions are reported. The largest differences in comparison with rural areas are observed in building quarters and also on concave relief forms.

24820 **APTIC NO. 46016**

Osipov, Yu. S.

DIFFUSION FROM A POINT SOURCE OF FINITE TIME OF ACTION. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 77-84. 11 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 207-214.)*

NTIS: PB 210653

The dependence of the density distribution of a pollutant deposit on the ground surface in a direction lateral to the average wind upon the duration of elevated point source operation is considered. The results of model experiments are analyzed, in which sources of different operating time were used simultaneously. The dispersion of lateral pollutant distribution grows with the increase of duration of source operation, and axial deposit densities decrease. Experimental results are presented in a normalized form and generalized in some empirical curves depending on duration of source operation. The variation of the time-averaged axial density of the impurity deposit was inversely proportional to the averaging time to a power ranging from 0.2 to 0.4.

24821 **APTIC NO. 46020**

Parczewski, W.

FIELD STUDIES OF AIR POLLUTION IN THE AREA OF THE SKAWINA ELECTRIC POWER PLANT. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 109-111. 3 refs. Translated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 238-240.)*

NTIS: PB 210653

A power station in Skavine with output of 400 MW is a powerful source of sulfur dioxide emission. Field investigations of pollutant diffusion were carried out in 1961. Two cars were situated directly under the plume at different distances from the stack during measurement periods. Observations of plume form and rise included photographing by means of a camera mounted on a special tripod head that made it possible to rotate the camera along the vertical axis and to adjust it relative to the horizontal by means of micrometer-type screws. A fixed lower section of the camera simultaneously took pictures of the smoke band. The angles and heights were read off directly from the image of the plume on the ground glass by using the scales marked on it. The measurements were made every 5-10 minutes. Outlines of the smoke plume were drawn and photographed at half-hourly average intervals. The actual height at which spreading of smoke in the atmosphere took place was highly variable. In most cases, there was no natural increase in the effective stack height. A marked plume ascent was observed only in certain ranges of wind velocity at the level of the stack orifice.

24822 **APTIC NO. 45940**

Park, Kyoung Yoon

AN EXTENSION OF THE SIMPLE MATHEMATICAL MODEL BY GIFFORD AND HANNA FOR THE ESTIMATION OF URBAN AIR POLLUTION. *National Oceanic and Atmospheric Administration, Oak Ridge, Tenn., Air Resources Atmospheric Turbulence and Diffusion Lab., Rept. ATDL-60, 16p., March 1972. 5 refs.*

Based on the Gaussian diffusion model, an extension of the Gifford-Hanna simple method for estimating average surface concentrations of pollution in urban areas is presented. Surface concentrations of natural gas in the Los Angeles basin calculated from Lamb s more complex model and from the Gifford-Hanna model were compared. The extended method is suitable for evaluation of urban air polltuion, but is only a slight improvement over the Gifford-Hanna model. The model incorporates point, line, and area sources and includes parameters of wind speed and direction, effective source height, ground level concentrations, wind rose, stability classes, and vertical distribution of pollutants.

24823 **APTIC NO. 45844**

Parkin, D. W. and D. R. Phillips

PARTICULATE MATTER IN ANTARCTIC SNOW. *Geophys, J. Roy. Astron. Soc., 27(1):15-22, May 1972. 10 refs.*

Dust particles larger than 1 micron were settled out of 71.4 kg of meltwater from a 30 year-old site at the base of the ice cliff at Halley Bay. The snow was returned in frozen blocks; sampling the interior of these blocks under clean room conditions gave about 1 microgram of 1 to 4-micron particles which were judged to be clay mineral naturally present in the snow. About 0.8 mg of sticky white organic matter, several dozen 100-micron particles of geothite and haematite paint flakes, and quartz were also found. These were believed to be contaminants. The concentration of clay mineral was about 1.4 times 10 to the -11th power g/g snow; the dust load in Antarctic air was about 2.2 times 10 to the -5th power micrograms/cu m air. No black magnetic spherules were seen, and nothing from outer space was recognized. The high nickel dissolved in polar snow seems definitely extra-terrestrial, but the other elements may be land derived via Aitken nuclei of order 100/cu m air, the global background. (Author abstract)

24824 **APTIC NO. 45875**

Peterson, James T.

CLIMATIC ASPECTS OF WASTE HEAT. *Preprint, Society of Engineering Science, Inc., Washington, D. C., 16p., 1972. 9 refs. (Presented at the Society of Engineering Science, International Meeting, 1st, Tel Aviv, Israel, June 1972.)*

Nearly all human activity results in the generation of heat. A large fraction of this energy results from burning fossil fuels and generation of electricity. This release of heat is largely responsible for the urban heat island. The excess warmth of cities, especially at night during anticyclonic weather situations, can exceed 10 C on occasion and averages 1 to 2 C annually for large cities. The warmer urban surface cause a weak low-level air circulation, with a component toward the city center superimposed on the regional wind flow. The altered thermal environment also affects the dispersion of pollutants, the growing season, and amount of precipitation. The most significant non-climatic effect is the discomfort to the populace, especially during humid summer evenings, and the excess urban mortality during prolonged hot weather. In western Europe, the waste heat ranges between 8%, 2%, and 1.5% of the net radiative energy balance, respectively, for different French, German, and British locations. But, averaged over the land area of the earth, thermal pollution is only about 0.1% of the net radiative energy balance. However, by the year 2000 there will be several areas in the world of 100,000 to perhaps 1,000,000 sq km with waste heat of several percent of the energy naturally received from the sun. The large-scale climatic consequences of such energy use are uncertain, but are currently under study through the use of global atmospheric models.

24825 **APTIC NO. 46069**

Phillips, David T. and Philip J. Wyatt

SINGLE-PARTICLE LIGHT-SCATTERING MEASUREMENT: PHOTOCHEMICAL AEROSOLS AND ATMOSPHERIC PARTICULATES. *Appl. Opt., 11(9): 2082-2087, Sept. 1972. 12 refs.*

The use of single-particle light-scattering measurements to determine the origin of photochemical atmospheric hazes was explored by measurement of laboratory aerosols and field samples, and computer analysis of the light-scattering data. The refractive index of measured spherical particles 800-1000 nm in diameter was determined within 2%. For particles of diameter less than 500 nm, absolute scattering intensity must be measured for complete analysis. Distinctive nonspherical and absorbing particles were determined in automotive exhaust and atmospheric samples. Electrostatic suspension of atmospheric particulates was demonstrated to provide a practical approach to optical measurement of single particles. (Author abstract modified)

24826 **APTIC NO. 45689**

Plummer, P. L. M. and B. N. Hale

MOLECULAR MODEL FOR PRENUCLEATION WATER CLUSTERS. *J. Chem. Phys., 56(9):4329-4334, May 1, 1972. 21 refs.*

A molecular model applicable to prenucleation water clusters is described. As an illustration, the model is applied to water clusters having clathrate-like structures composed of five-membered rings. The approach was to assume a relatively strong hydrogen bond and impose relatively reasonable criteria for a cluster structure model. The clusters were chosen arbitrarily, and are not claimed to exist in the supersaturated vapor. The first step is to incorporate characteristic properties of the water molecule explicitly without sacrificing the feasibility of a solution. As such, it offers an alternative midway between treating 5 to 100-molecule water clusters as liquid drops and the nearly impossible complete molecular treatment. A number of approximations were made in evaluation of the standard change in Gibbs free energy accompanying the formation of a cluster with 5 to 57-molecules-sized clusters. The study was motivated by the apparent inadequacies of the corrected liquid-drop model, which (in addition to applying bulk properties to small clusters), predicts nucleation rates which may be as much as 10 to 17th power larger than experiment. These results agree qualitatively with experiment, prove that an alternative to the liquid-drop model exists, and provide a motivation for further development of the molecular approach.

24827 **APTIC NO. 45349**

Schlesinger, Robert Edward

A NUMERICAL MODEL OF DEEP MOIST CONVECTION: THE INFLUENCE OF AMBIENT CONDITIONS AND INTERNAL PHYSICAL MECHANISMS. *Wisconsin Univ., Madison, Dept. of Meteorology, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., Jan. 1972, 357p. 71 refs.*

The influence of both ambient conditions and certain internal physical processes upon the behavior of deep moist convection in the atmosphere was discussed. By means of a two-dimensional numerical model, an inelastic system of hydrodynamic and thermodynamic equations was integrated to simulate convection of the squall-line type. The research covered three main phases: the joint influence of the low-level relative humidity and mid-tropospheric wind shear upon the intensity and persistence of the convection at maturity; further analysis of the dynamics and kinematics for a prototype storm which during maturity exhibits a quasi-steady configuration resembling some observed severe thunderstorms; and isolation of the effects of individual physical mechanisms and alterations in the initial conditions by performing several variations upon the prototype experiment. The results of the comparative experiments have indicated that the intensity of convection (maximum updraft velocity, maximum rainfall rate, or the size of the precipitation region) increases with increasing low-level moisture supply and decreases with increasing midtropospheric wind shear.

24828 **APTIC NO. 46383**

Schuurmans, C. J. E.

ATMOSPHERIC POLLUTION AFFECTING THE CLIMATE. II. *(II. Klimatologische gevolgen van de verontreiniging van de atmosfeer). Text in Dutch. Ingenieur, 84(32/33):27-29, Aug. 11, 1972.*

The possible effects of carbon dioxide, dust aerosols, and jet aircraft exhaust emissions on the climate are discussed. The atmospheric CO2, has increased for many decades; it lowers the thermal radiation from the earth surface and increases the temperature of the lower atmospheric layer, the so-called greenhouse effect. An increase of 0.6 C in temperature, recorded over the period 1880-1940, may be partly due to the increase in the atmospheric CO2 concentration. The atmospheric dust aerosol concentration of 200/cu m increased by more than 100% compared to the 1930 level. While this increase is partly due to human activity, tropospheric aerosols usually stem from volcanic eruptions. The aerosol concentrations show an exponential decrease with altitude. Dust aerosols can influence atmospheric temperature, depending on albedo and humidity, by dissipation and possible absorption of solar and other radiations. The condensation trails of jet aircraft can cause condensation, cirrus cloud formation, and considerable dust accumulation in the stratosphere. Up to 10% more vapor than normal along jet aircraft routes was measured. Jet aircraft exhaust emissions may affect the albedo, reducing it to a value of 0.4-0.5, the absorption of long-wave radiation, and have a seeding effect. Chemical reactions of water vapor, nitric oxide, and ozone lead to decreased ozone and increased CO2 content with a temperature drop as a result. The great albedo of snow and ice covers in polar regions may lead to an extension of the polar ice caps according to a recent theory.

24829 **APTIC NO. 45457**

Semenov, A. A., A. A. Tishchenko, and T. I. Arsen yan

THE USE OF DIFFRACTION ANTENNAS IN THE VISUAL RANGE TO STUDY PROPAGATION OF LASER RADIATION IN THE ATMOSPERHE. *(O primenenii diffraktsionnykh antenn v opticheskom diapazone dlya issledovaniya rasprostraneniya izlucheniya OKG v atmosfere). Text in Russian. Fizika, 15(2):144-146, 1972. 6 refs.*

A diffraction antenna (single-form aperture) was used to study the propagation of troposphere-modulated laser radiation in a turbulent atmosphere. Changes of the radiation pattern, resulting from the effect of random inhomogeneities of the medium in the Fraunhofer diffraction zone, were studied. Increased width of the main maximum with increasing intensity of the fluctuations of the refraction index was observed. The calculations were based on the structure function of the wave phase fluctuations, and normal distribution of the wave phase in the troposphere was assumed. Theoretical and experimental data for the distribution of light intensity under various meteorological conditions in a turbulent medium model show good agreement.

24830 **APTIC NO. 45854**

Snyder, William H.

FLUID MODELS FOR THE STUDY OF AIR POLLUTION METEOROLOGY: SIMILARITY CRITERIA, FACILITIES, REVIEW OF LITERATURE, AND RECOMMENDATIONS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Div. of Meteorology, 106p., May 19, 1972. 229 refs.*

In using fluid model facilities such as wind tunnels to study atmospheric motions, it is necessary to apply certain similarity criteria or rules which ensure that thd model performance will be similar in some manner to the behavior of the natural atmosphere. These criteria require that certain nondimensional parameters which characterize the particular state of the atmosphere be duplicated in the model. In general, duplication of all of these nondimensional parameters is impossible, so that a comprise must be made. The significance of these nondimensional parameters and the restrictions under which their duplication in the model may be disregarded are discussed. The literature on many fluid model studies of air pollution meteorology is reviewed. Brief descriptions are given of the facilities of the major modeling establishments in the United States, England, France, Canada, Japan, and the Soviet Union. Finally, recommendations are made concerning actions to be taken along the lines of fluid modeling of air pollution meteorology.

24831 **APTIC NO. 46083**

Sodergren, A.

CHLORINATED HYDROCARBON RESIDUES IN AIRBORNE FALLOUT. *Nature (London), 236(5347):395-397, April 21, 1972. 7 refs.*

In an analysis of the input and output of chlorinated hydrocarbon residues in a freshwater ecosystem in south Sweden, the amount entering the study area by means of precipitation and by airborne particles was estimated. The fallout was trapped on a 200-micron nylon net (30 by 30 cm) which, in a standardized procedure, had been impregnated with a thin film of silicone oil (SE 30). The chlorinated hydrocarbons were collected and retained in the oil. Small particles, organic as well as inorganic, also became firmly attached to the net. The impregnated nets were exposed in open places for 2 to 3 months. The samples were run on three different gas chromatography columns. The most frequent direction of the wind was from West to Southwest. The study area is subjected to airborne material originating from industries along the Swedish west coast and in the Copenhagen area, as well as from heavily industrialized districts in West Germany. The highest average monthly levels of Epsilon DDT (p,p-DDT+p,p-DDE) were trapped at station G in the period Jan.-March 1971 (2075 ng/sq m/mo), at station E in the period Feb.-April 1970 (1350 ng/sq m/mo), and in the area of station F during the period Jan.-March 1971 (1650 ng/sq m/mo). The highest average of polychlorinated biphenyls was found in the area of station A in Jan.-March 1971 (10,510 ng/sq m/mo), station B in the same period (9860 ng/sq m/mo), and station D in the same period (5980 ng/sq m/mo). The regional distribution of Epsilon DDT was more uniform than that of PCB. The origin and general routes of transport of PCB compounds to the environment are not fully understood. The PCB compounds are generally found in airborne fallout. Transport by air or airborne particles is one of the main routes in the dispersal of PCB. In southern Sweden, there is regional variation in PCB levels. Correlated with the prevailing winds, it is suggested that part of the PCB compound originated not within the study area but further afield.

24832 **APTIC NO. 46186**

Spedding, D. J.

SULPHUR DIOXIDE ABSORPTION BY SEA WATER. *Atmos. Environ., 6(8):583-586, Aug. 1972. 9 refs.*

Laboratory studies were made to determine the deposition of sulfur dioxide on the ocean and its subsequent absorption. The absorption of SO2 by sea water was measured using a small scale laboratory apparatus with a S-35 isotope of SO2 at atmospheric concentrations. Sulfur (35) activity in solution was monitored by the scintillation flow cell and a single channel beta spectrometer, the data being recorded on a strip-chart recorder. The output from the pH meter was simultaneously displayed on the strip-chart. The velocity of deposition of SO2 varied with gas flow rate reaching 1.44 cm/sec in turbulent conditions. Gas phase diffusion probably limits the absorption of SO2 by sea water, and oceans may be a major sink for atmospheric SO2. (Author abstract modified)

24833 **APTIC NO. 46379**

Stepanow, Vitali

OCEAN AND ATMOSPHERE. *(Ozean und Atmosphaere). Text in German. Ideen exakten Wissens, 1972:527-538, Aug. 1972. 8 refs.*

General features of the mass circulation system in the oceans and the atmosphere are described. The horizontal thermal fields, arising from the horizontal inhomogeneities due to the complicated distribution of the solar energy, lead to the transport and circulation of air and water masses, ehich may generate vertical drifts. The atmosphere, like the oceans, shows pronounced stratification, and independent circulatory systems at the boundaries of the individual zones. Atmospheric mass transfer and redistribution processes unlike those in the ocean, are influenced by cosmic factors. Modification of the atmospheric circulation begins in the lower layer of the troposphere, and the pressure field very much resembles the temperature field at altitudes over 5 km. Depression zones in the upper layer of the troposphere over arctic regions, and high-pressure zones in the same layer over tropic regions are observed. The pressure gradients increase during winter, and decrease during summer, especially in the northern hemisphere. The pressure gradient increasing with altitude generates intensified updrift. The physical and chemical characteristics of the stratosphere are largely determined by those of the troposphere, which is in connection with the presence of ozone. Mass transport processes along the boundary of the hydrosphere and the atmosphere are of the same type, while the processes occurring in higher atmospheric layers are considerably influenced by solar and cosmic energy transformation phenomena.

24834 **APTIC NO. 46236**

Stevens, C. M., L. Krout, D. Walling, A. Venters, A. Engelkemeir, and L. E. Ross

THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE. *Argonne National Lab., Ill., Chemistry Div. and Argonne National Lab., Ill., Chemical Engineering Div., 49p., 1972. 32 refs.*

A program of measuring the isotopic composition of carbon monoxide in the atmosphere and from natural sources has included two separate problems: the determination of the global average isotopic composition of CO emitted by internal combustion engines, and the determination of the isotopic pattern of CO in the least polluted atmosphere (mostly in Illinois) at different seasons and, where possible, different latitudes and times of day. Atmospheric samples were collected in aluminum cylinders and were processed to convert CO to carbon dioxide. Samples were isotopically analyzed for both carbon and oxygen using a modified Consolidated-Nier isotope-ratio mass spectrometer with a semi-automatic data collecting system. Concentration and the carbon and oxygen isotopic composition of the atmospheric CO of the northern hemisphere show regular seasonal variations. The isotopic pattern is different from that for CO from automobile engine combustion, indicating that there are several natural sources, one of which is much greater than anthropogenic emissions. The most likely nature of these sources is discussed and the production rates estimated. (Author abstract modified)

24835 **APTIC NO. 45798**

Turner, D. Bruce and Dale H. Coventry

GRAPHS FOR ESTIMATING MAXIMUM FUMIGATION CONCENTRATIONS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Div. of Meteorology, 26p., April 1972. 5 refs.*

Frequently, at night, surface based inversions form due to the radiational cooling of the ground and the air near the ground. During the daytime, heating by the sun eliminates this inversion at the ground and, with time, through successively higher layers. When the inversion is eliminated to the height of a pollutant plume, trapped in the stable air, this pollution is mixed rapidly between the ground and its former height, causing very high ground-level concentrations called inversion break-up fumigation. The equations for downwind concentrations of air pollutants, under conditions of fumigation by inversion elimination, were solved on a computer. The results are displayed in the form of computer-drawn graphs of normalized concentrations versus downwind travel-times for an assortment of stack heights. The graphs are intended to eliminate much of the labor involved in calculating fumigation concentrations. (Author abstract modified)

24836 **APTIC NO. 45753**

Tyson, P. D., W. J. F. du Toit, and R. F. Fuggle

TEMPERATURE STRUCTURE ABOVE CITIES: REVIEW AND PRELIMINARY FINDINGS FROM THE JOHANNESBURG URBAN HEAT ISLAND PROJECT. *Atmos. Environ., 6(8):533-542, Aug. 1972. 35 refs.*

Data on the development of heat islands over South African cities and general information on the vertical temperature structure above cities are outlined. The urban heat islands that develop over cities are usally characteristic and are influenced not only by the nature and outline of the built-up areas, but also by local topographically induced climatic variations. The urban heat island phenomenon was investigated over Johannesburg to determine the extent to which its urban climate corresponds to those of other world cities; the extent to which its unique location imparts distinctive characteristics; and the nature of the processes producing and maintaining the urban heat island. Data on effects of altitude temperature distribution, inversion conditions, seasonal and diurnal variations, lapse rates, convection, wind speeds, and radiation levels were collected. Vertical temperature distribution charts are also presented for San Francisco, Columbus, Montreal, New York, and Cincinnati.

24837 **APTIC NO. 45715**

Vilensky, V. D.

RECENT DEPOSITION OF SPHERICAL MICROPARTICLES IN THE SNOW COVER OF THE ANTARCTICA. *Text in Russian. Geokhimiya, no. 5:592-599, 1972. 17 refs.*

The distribution of spherical black microparticles in the snow cover of some Soviet Antarctic regions and the precipitation intensity values of the particles were calculated. Particle precipitation intensity onto the surface of the earth sharply decreased when traveling from the coast into Antarctica. The intensity varied annually, with different variations depending on the regions. The observed distributions in space and time of microparticle deposition in the snow cover were assumed to be processes of transport.

24838 **APTIC NO. 46156**

Wofsky, Steven C., John C. McConnell, and Michael B. McElroy

ATMOSPHERIC CH4, CO, AND CO2. *J. Geophys. Res., 77(24):4477-4493, Aug. 20, 1972. 80 refs.*

The chemistry of atmospheric methane, carbon monoxide, and carbon dioxide is treated with a one-dimensional model incorporating the effects of eddy diffusion in the altitude region of 0-120 km. Methane is well mixed up to about 20 km, and its mixing ratio declines steadily at higher altitudes. Carbon monoxide is well mixed in the troposphere. Its mixing ratio decreases initially in the lower stratosphere, reaches a minimum value of the order of 10 to the minus 8th power near 30 km and increases steadily at higher elevations. Carbon dioxide is also well mixed in the troposphere. Its mixing ratio declines somewhat in the stratosphere, and this decline reflects the importance of anthropogenic production of CO2 and the relatively long time constants for stratospheric diffusion. Mixing ratios of CO and CO2 are comparable near 120 km. Combustion is a minor source of CO in comparison with the oxidation of CH4, which is a significant source of stratospheric water and hydrogen. The principal sinks for CO and CH4 involve reactions with hydroxide ions. Carbon dioxide is removed at the surface and to a lesser extent in the atmosphere by photolysis. Mean residence times for CO and CH4 are 0.3 and 7 years, respectively. (Author abstract modified)

24839 **APTIC NO. 45563**

Zadoks, J. C.

FLYING FUNGI. *(Vliegende schimmels). Text in Dutch. Preprint, Agricultural Univ., Wageningen (Netherlands), Lab. voor Fytopathologie, 18p., Jan. 1972. 43 refs. (Presented at the Aerobiology Symposium, Wageningen, Netherlands, Jan. 27, 1972.)*

The mechanism of the dispersal and transport of fungi spores in air are reviewed. The liberation of spores, requiring their passage from a layer of laminar flow into turbulent air, is facilitated by special squirting mechanisms in certain species (ascomycetes, Sordaria fimicola). Spores can also be released by raindrops. The relaxation time of liberated spores with 10-micron radii is 1 m/sec. Both the production and the flight of spores has distinct diurnal periodicity, controlled by environmental phenomena. The long-distance transport of spores of Puccinia graminis from the Iberian peninsula was studied. Spore clouds with thicknesses of 1-2 km can be carried by wind over large distances. The deposition of spores is possible by sedimentation and especially by impaction from near-surface layers, and due to the washout effect from higher layers of the atmosphere. Various factors influencing the penetration and viability of spores on deposition, e.g., shape and wall thickness, are reviewed. The rate of sedimentation of spores with 10-micron radii is 0.01 m/sec. Various factors determining the penetration and viability of spores on deposition, e.g., shape and wall thickness, are reviewed.

24840 **APTIC NO. 46010**

Zaytsev, A. S.

AUTOMATION OF INFORMATION PROCESSING INVOLVED IN EXPERIMENTAL STUDIES OF ATMOSPHERIC DIFFUSION. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Technical Papers from the Leningrad International Symposium on the Meteorological Aspects of Atmospheric Pollution. Part II. M. Y. Nuttonson (ed.), Vol. 13, Silver Spring, Md., American Institute of Crop Ecology, 1972, p. 1-7. 11 refs. Tranaslated from Russian. (Also: Meteorologisheskie Aspekty Zagryazneniya Atmosfery, Proc. Int. Symp., Leningrad, USSR, 1968, p. 130-136.)*

NTIS: PB 210653

Experimental investigations of atmospheric diffusion include the measurements of meteorological and turbulent air current characteristics and pollutant concentrations by quick-response sensors. The automation of data treatments is connected with primary treatment, information memorization, and subsequent treatment on electronic computers. The employment of helicopters and cars supplied by automatic instruments for air pollution investigation leads to the necessity of prompt processing of information in stationary conditions. For this purpose, the method of automatic and semiautomatic treatment of information read out from oscillographic tapes is used. For some problems, memorization of coded measured quantities is possible directly in field conditions. In connection with this, the methods of automatic reading of sensors, information memorization, calculation of averages for a definite time period and data coding on punched tape are used. The final data treatment is carried out on electronic computers. The calculations and analysis of turbulent coefficients and of the parameter which characterizes the wind direction variability are carried out on obtained measurement results, and records of automatic gas analyzers are also treated semi-automatically.

1971

24841 **APTIC NO. 45536**

World Meteorological Organization, Geneva (Switzerland)

WMO OPERATIONS MANUAL FOR SAMPLING AND ANALYSIS TECHNIQUES FOR CHEMICAL CONSTITUENTS IN AIR AND PRECIPITATION. *Rept. 299, 36p., 1971. 20 refs.*

Sampling and analysis techniques related to determinations of atmospheric phenomena are reviewed. Station categories, siting criteria, and programs for regional air pollution stations are examined. The principles of turbidity measurements, including direct solar radiation instruments and the sun photometer, are examined, and techniques for the determination of the chemical composition of precipitation are considered. The analytical methods for the determination of contents of sulfates, chlorine, ammonia, nitrogen trioxide, calcium, magnesium, sodium, and potassium; alkalinity; electrical conductivity; and pH of precipitation samples include photometric titration, spectrophotometry, and flame photometric methods; alkaline titration; conductivity detectors; and standard pH instruments.

24842 **APTIC NO. 45375**

Byrne, William M., Jr. and Shen C. Lee

A DIFFERENTIAL METHOD FOR THE PREDICTION OF THE EFFECTS OF ATMOSPHERIC BOUNDARY LAYER TURBULENCE USING THE TURBULENCE KINETIC ENERGY EQUATION. *Preprint, 14p., 1971. 10 refs. (Presented at the Symposium on Air Pollution Turbulence and Diffusion, Las Cruces, N. Mex., Dec. 7-10, 1971.)*

The effects of atmospheric boundary layer turbulence were modeled in a simultaneous solution of the turbulence kinetic energy equation with the equations of continuity and momentum. The analytical results are compared with experimental data for turbulent boundary layers in the presence of negative, positive, or zero pressure gradients and turbulent boundary layers with blowing or suction with generally satisfactory agreement for both mean velocity and shear stress distributions. The effects of mass transport are also considered. (Author conclusions modified)

24843 **APTIC NO. 45573**

Conrads, L. A. and P. J. Jonker

THE KRECKE RAIN GAUGE OF 1849 AND ITS USE IN A STUDY ON THE INFLUENCE OF UTRECHT CITY ON THE CHEMICAL COMPOSITION OF THE RAIN WATER. *(De regenmeter van Krecke uit 1849 en zijn betekenis bij het onderzoek naar de invloed van de stad Utrecht op de chemische samenstelling van het regenwater). Text in Dutch. Hemel Dampkring, 69(7/8):178-182, July-Aug. 1971. 5 refs.*

Krecke s rain gauge and recent studies on the influence of Utrecht city on the chemical composition of the rain water sampled by Krecke s gauges in and around the city are described. Monthly samples from rain gauges placed at 200 cm to the east, south, west, and north of and in the city were chemically analyzed, and wind speeds and directions were recorded. The pollutant content in precipitation is dependent on dispersion processes, and also on the washout effect and the background concentration in the precipitation.

24844 **APTIC NO. 45350**

Cramer, Joseph John

MATHEMATICAL MODELS OF CHEMICAL POLLUTION OF THE ENVIRONMENT. *Pennsylvania Univ., Philadelphia, School of Chemical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1971, 111p. 137 refs.*

Models of three different types of chemical pollution of the environment were developed. The primary objectives were to develop models that could be useful as predictive tools and to delineate those parameters which require more intensive research. The three types of pollution modeled were the photochemical pollution of the Los Angeles environment, the gradual accumulation of carbon dioxide in the atmosphere, and the global accumulation and distribution of DDT. The Los Angeles model assumed the steady-state to account for free-radical concentrations and source and removal terms were modeled after traffic density and meteorological data. The system was assumed to be well-mixed. The model predicts that control of nitrogen oxides may cause slight increases in the atmospheric concentration of oxidants; the control of hydrocarbons is a far more effective way of limiting the concentration of oxidants. Based on the CO2 model, the minimum concentration of CO2 in 2000 will be 350 ppm and the minimum concentration in 2100 will be 495 ppm. The atmospheric concentration is very sensitive to the rate of photosynthesis by phytoplankton. Any decrease in the rate of photosynthesis would cause substantial increases in the atmospheric concentration of CO2. The DDT model predicts that, given the present rate of DDT usage, we are already close to the equilibrium concentration of DDT in the sea, in phytoplankton, and in zooplankton. However, the response to an immediate cessation of DDT production is relatively rapid with a 75% reduction in 15 years.

24845 **APTIC NO. 45491**

Djolov, G.

TURBULENT DIFFUSION OF IMPURITIES IN A STATIONARY STRATIFIED BOUNDARY LAYER OF THE ATMOSPHERE. *(Turbulentna dufuziya na primesi v statsionaren temperaturno stratifitsiran granichen sloy na atmosferata). Text in Bulgarian. Khidrol. Meteorol. (Sofia), 20(2):11-22, 1971. 11 refs.*

An expression is presented to describe the distribution of impurities in the boundary layer of the atmosphere from a high continuous point source. Turbulent diffusion in a horizontal direction is described statistically, while in a vertical direction it is described by means of the solution of the equation of turbulent diffusion in appropriate boundary conditions. The distribution of impurities in relation to the Rossby number of the outer parameters is investigated for the parameters of stratification and source height. Comparison of experimental data with the theoretical results shows a satisfactory agreement. (Author summary modified)

24846 **APTIC NO. 45666**

Drugmand, L.

DISPERSION OF GASEOUS POLLUTANTS IN THE AIR. *(La dispersion des pollutants gazeux dans l'air). Text in French. Ann. Gembloux, 77(2):121-131, 1971.*

The theory of the atmospheric dispersion of gaseous pollutants and general problems of experimental studies of dispersion are outlined. Atmospheric dispersion is influenced by wind speed and direction, chemical or photochemical reactions, and topographic factors. In the presence of fog, dust can catalyze the oxidation of sulfur dioxide to sulfur trioxide; ultraviolet rays and nitrous vapors can combine to produce ozone, which reacts with nitric oxide to form nitric acid. Smoke from point sources can form cone-shaped plumes resulting in maximum ground-level concentrations. The temperature gradient, a meteorological exponent dependent on wind speed and usually having a value of 0.25, and the diffusion coefficients in directions perpendicular to the wind direction in horizontal and vertical plane, as well as the effective source height, are factors to be considered for theoretical dispersion calculations. The diffusion coefficient is dependent on wind speed, turbulence, and the kinematic viscosity of air. The necessary stack height, to be calculated for maximum surface-layer concentrations, is best multiplied by a correction factor larger than one to consider orographic irregularities. Both the background concentration and the total concentration as a function of wind direction should be determined in experiments. Two recorders, one for the wind side and one for the lee side, as well as an analyzer furnishing 24 hour-means should be used for dispersion studies; and additional recordings of wind speed and direction, precipitation, cloudiness and inversions should be conducted. Data obtained from longterm measurement programs permit the determination of daily and seasonal variations, frequencies of different concentration levels, and the probability of high pollution levels.

24847 **APTIC NO. 45383**

Greenway, A. Roger and David S. Lydon

DETERMINATION OF MAXIMUM EMISSION RATES TO MEET AIR QUALITY STANDARDS. *Air Force Environmental Technical Applications Center, Washington, D. C., TN 71-9, 22p., Aug. 1971. 5 refs.*

NTIS: AD 733505

Calculations to determine permissible stack emissions within the limits of air quality standards for certain air force bases are examined. Downwind ground level concentrations were estimated for effective stack heights of 30, 50, and 70 ft, based on graphs of emission rates versus downwind distances. The major factors within the dispersion calculations were emission rates, stack height, atmospheric stability, wind speed, and solar radiation. Data source, analysis procedure, graphs, occurrence maps, and experimental results are presented.

24848 **APTIC NO. 45603**

Haagen-Smit, A. J.

ABATEMENT STRATEGY FOR PHOTOCHEMICAL SMOG. *Preprint, American Chemical Society, Washington, D. C 28p., 1971. 28 refs. (Presented at the American Chemical Society, National Meeting, 161st, Los Angeles, Calif., March 28-April 2, 1971.)*

Photochemical air pollution caused by the action of sunlight on a mixture of oxides of nitrogen and organic materials has become a source of great concern in many large metropolitan areas. An orderly control program begins with the identification of the nature of the problem, and is followed by information on ambient air, emission standards, and a plan of action. The overall responsibility for control of photochemical smog has moved from local to state to federal authorities. In some seriously affected areas, technological control alone is not enough to meet the clean air standards. In these cases the control strategy will have to be directed towards prevention rather than cure. This strategy requires measures affecting the social and economic structure of society and enactment of new stringent air pollution laws. The gradual development of the control strategy and its adaptation to changes in environment and technology is illustrated with a case history of Los Angeles smog. Air basin capacity and model calculation are discussed. Technological problems encountered in getting an automobile design from the prototype to the production stage are also considered.

24849 **APTIC NO. 45586**

Leahey, Douglas McAdam

A MODEL FOR CALCULATING THE DEPTH OF THE MIXING LAYER OVER THE URBAN HEAT ISLAND. *New York Univ., N. Y., School of Engineering and Science, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., Feb. 1971, 110p. 53 refs.*

A simple advective thermodynamic model is used to predict the depth of the mixing layer over the New York urban area. The model is essentially the same as the one proposed by Summers except for the addition of a heat sink term. This term allows for consideration of the effects of cooling downwind of an urban area. Correlation coefficients between observed and predicted mixing depths for non-summer months were about .86. Experience has shown that for the cases studied, the correlation is not sensitive to small variations in wind velocity nor to the inclusion of the heat sing terms. Predictions of sulfur dioxide distributions were also made with the model. These predictions were made using the assumption that within the mixing layer pollutants are homogeneously distributed in the vertical. A comparison between more than 400 predicted and observed values of SO2 mixing ratios yielded a correlation coefficient of .83. Other uses of the model are briefly considered. In conjunction with vertical temperature profiles the model may be used to estimate the heat release from concrete and pavements during summer mornings. The effects of calms on the mixing depth and SO2 distributions are also considered. Calms of two hours duration can result in raising pollution levels by about 500%. (Author abstract modified)

24850 **APTIC NO. 45550**

Marshall, James Milton

A RADIO ACOUSTIC SOUNDING SYSTEM FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC PARAMETERS. *Stanford Univ., Calif., Dept. of Electrical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., March 1971, 163p. 28 refs.*

It is proposed that a Radio Acoustic Sounding System, using the interaction of electromagnetic and acoustic waves, may be used for the remote measurement of atmospheric parameters such as wind, turbulence, and air temperature. A mathematical and physical model for the system performance and with basic design considerations was developed. The results of an experimental investigation of the electromagnetic-acoustic interaction concept over the first 2 km in altitude and the mathematical model for the electromagnetic-acoustic interaction process are presented. A RASS terminal measures wind velocity and air temperature by generating a short, high-intensity acoustic pulse and tracking it with a Doppler radar unit which measures its velocity. The measured velocity is comprised of two components: the normal acoustic velocity, or velocity of sound, which is proportional to the square root of temperature, and a component of the wind velocity. The magnitude and direction of winds may be determined from directional sighting or with multiple terminals. Large scale turbulence appears as a spatial variation in the wind. A measure of the small scale turbulence is given by the Doppler spread of the received radar signal.

24851 **APTIC NO. 45462**

Mitchell, J. Murray, Jr.

THE EFFECT OF ATMOSPHERIC AEROSOLS ON CLIMATE WITH SPECIAL REFERENCE TO TEMPERATURE NEAR THE EARTH S SURFACE. *J. Appl. Meteorol., 10(1):703-714, Aug. 1971. 21 refs.*

A generalized model of the effect of an optically thin atmospheric aerosol on the terrestrial heat budget is proposed and applied to the problem of estimating the impact of the aerosol on temperatures near the earth s surface. The distinction between warming and cooling depends on whether the ratio of absorption, a, to backscatter, b, of incoming solar radiation by the aerosol is greater or less than the critical ratio (a/b), which is equal to $C(1-A)(1-Ak)/(D(1+A)-C(1-A))$. A is the surface albedo, C the fraction of sensible to total solar heating of the surface, D the fraction of aerosol that is in convective contact with the surface, and k a multiple of b that measures the relative aerosol backscattering efficiency with respect to solar radiation reflected upward from the surface. A distinction is drawn between a stratospheric aerosol which may either cool or warm the atmosphere near the surface depending on various properties of the aerosol and of the surface itself. Over moist surfaces, such as vegetated areas and oceans, the critical ratio (a/b)O is of the order 0.1; over drier surfaces, such as deserts and urban areas, (a/b)O is the order unity. If the actual ratio a/b of most tropospheric aerosols is of the order of unity, then the dominant effect of such aerosols is warming except over deserts and urban areas where the effect is somewhat marginal between warming and cooling. Further aerosol climatic effects are likely to include a slight decrease of cloudiness and precipitation, as well as an increase of planetary albedo above the oceans. Previous suggestions to the effect that the apparent worldwide cooling of climate in recent decades is attributable to large scale increases of particulate pollution are not supported by this analysis. (Author abstract modified)

24852 **APTIC NO. 45500**

Pasquill, F.

EFFECTS OF BUILDINGS ON THE LOCAL WIND. WIND STRUCTURE IN THE ATMOSPHERIC BOUNDARY LAYER. III. *Phil. Trans. Roy. Soc. London Ser. A, 269(1199):439-456, May 13, 1971. 26 refs.*

The semi-empirical laws for the variation of mean wind speed with height and for the statistical properties of turbulent fluctuations are briefly outlined. Similarity considerations provide some useful ordering of the mean wind profile characteristics in relation to surface roughness and thermal stratification. Appreciable uncertainties prevail, however, especially as a consequence of the effect of thermal stratification and of variable terrain roughness. Some generalization on similarity grounds can also be made regarding the fluctuations of horizontal wind speed as a function of roughness and stability, but there are wide variations of spectral density and scale which are not immediately explicable and which at present preclude anything more than a relatively coarse specification of the spectrum. Features which are of special relevance to architectural aerodynamics and which are discussed include: the difficulty of generalizing about the wind profile and turbulence above an urban complex; the requirement for estimating the magnitudes of extreme gusts as a function of mean wind speed, averaging time, and height; the problem of generalizing about flow properties below roof level; and the effect of urban airflow on the travel and dispersion of pollutants. (Author abstract modified)

24853 **APTIC NO. 45622**

Semonin, Richard G.

STUDY OF RAINOUT OF RADIOACTIVITY IN ILLINOIS. *Illinois State Water Survey, Urbana, Atomic Energy Commission Contract AT(11-1)-1199, COO-1199-20, 58p., Nov. 1971. 26 refs.*

The field project phase (ITREX) of the Illinois State Water Survey during 1971 was continued in the St. Louis area as an integral part of Project METROMEX, a field effort to determine the effects of an urban area on precipitation. Unique chemical tracers released into the updrafts of convective clouds were used to estimate the scavenging efficiency of the treated clouds. Since the field work was only recently concluded, much of the data analysis is yet to be accomplished. A total of four storms were treated with lithium injected into the rain systems by a Piper Navajo aircraft utilizing acetone generators as the tracer delivery mechanism. Three additional burns were made from the ground into a local industrial smoke stack also using an acetone generator. Considerable background data were collected to determine the occurrence of various elements, including lithium, in rainwater and in dry precipitation. The design of ITREX as it relates to METROMEX is described.

BASIC SCIENCE AND TECHNOLOGY

1972

24854 **APTIC NO. 46171**

Balaji Gupta, R., B. Viswanathan, and M. V. C. Sastri

INTERACTION OF HYDROGEN AND CARBON MONOXIDE ON COBALT CATALYSTS. PART I. *J. Catalysis, 26(2):212-217, Aug. 1972. 16 refs.*

The adsorption of carbon monoxide and hydrogen was investigated in addition to mixtures in the ratio of 1 CO:1 H2 and 1 CO:2 H2, in the temperature range from 0-100 C on a cobalt-thoria-kieselguhr catalyst. Mutual enhancement of adsorption was revealed at higher temperatures. Analysis of the adsorbed phase suggests the formation of a carbon(hydrogen)hydroxy radical complex on the surface. Kinetics of the interaction of hydrogen with chemisorbed CO and the CO-H2 complex were also studied at different temperatures. The activation energies of these processes were evaluated and found to be too low for either of them to figure as rate determining in hydrocarbon synthesis. (Author abstract modified)

24855 **APTIC NO. 45645**

Beletskaya, I. P., A. L. Kurts, V. N. Smirnov, and O. A. Reutov

REACTIONS OF SULFUR TRIOXIDE AND DIOXANE SULFOTRIOXIDE WITH ORGANIC MERCURY COMPOUNDS. *(Vzaimodeystviye sernogo angidrida i dioksansul fotrioksida s rtutnoorganicheskimi soyedineniyami). Text in Russian. Izv. Akad. Nauk SSSR, Ser. Khim., no. 4:940-941, April 1972. 7 refs.*

Reactions of sulfur trioxide and dioxane sulfotrioxide with aromatic and aliphatic symmetric mercury compounds, producing mercury sulfonates, are described. Phenyl mercury salt of benzosulfonic acid was obtained from a reaction of diphenyl mercury with SO3 in the presence of dichloromethane at a yield of 95%. The same product was obtained from another analogous reaction of di-(p-tolyl)mercury with di-(p-chlorphenyl) mercury. A phenyl mercury salt of benzosulfonic acid was obtained from reactions of diphenyl mercury with dioxane sulfotrioxide at a yield of 90%, and of di-(p-tolyl)mercury and di-(p-chlorphenyl)mercury with dioxane sulfotrioxide. A reaction of SO3 with dibutyl mercury in the presence of dichloroethane resulted in n-butyl mercury salt of n-butyl sulfonic acid. An ethyl mercury salt of ethane sulfonic acid was obtained from a reaction of dioxane sulfotrioxide with diethyl mercury. A reaction of phenyl mercury bromide with dioxane sulfotrioxide produced a S-benzylthiuronic salt of benzosulfonic acid.

24856 **APTIC NO. 45675**

Blass, Eckhart and Kurt-Henning Koch

FLOW STUDIES ON A BUBBLE-COLUMN CASCADE REACTOR WITH UNIDIRECTIONAL FLOW OF GAS AND LIQUID. *(Stroemungstechnische Untersuchungen an einem Blasensaeulen-Kaskadenreaktor bei Gleichstrom von Gas und Fluessigkeit). Text in German. Chem.-Ing. Tech., 44(15):913-921, Aug. 1972. 17 refs.*

Particularly long residence times of the liquid phase can be achieved with a small amount of equipment in bubble column cascade reactors. A rising unidirectional flow of gas and liquid was studied, and the minimum gas throughput for a uniform gassing with perforated plates was measured. Water/air, n-dibutyl ether/nitrogen, octene/nitrogen, and octene/hydrogen were used as pairs of substances. Reactors of 100 mm diameter and 1200 mm height, and 140 mm diameter and 3250 mm height were available; they were run with several perforated plates having varying numbers of perforations and perforation diameters. The measured assignments of minimum gas and liquid throughput could be reproduced on the basis of a model theory for binary flow in a perforation with semi-empirical relationships. The measured residence time distributions are in line with the known equations for a series of ideal stirred tanks. Empirical equations are given for the overall pressure drop.

24857 **APTIC NO. 45741**

Cozzi, C. and D. Cadorin

NUCLEATION, GROWTH AND COAGULATION OF SOLID PARTICLES IN FLAMES. *Combust. Sci. Technol., 5(5):213-218, July 1972. 2 refs.*

A mathematical model is proposed for predicting the particle size distribution of the solid dispersed phase obtained as a product of a reaction between gaseous reactants. The model assumes that the particle formation occurs in different steps: gas phase reaction, particle nucleation, praticle growth via surface reaction, and coagulation. Integro-differential equations describing the process are set-up and solved by the moments method. Expressions for the first two moments of the particle size distribution, giving the particle concentration and the mean particle volume, are obtained as a function of time, reactant initial concentration, and nucleation, surface reaction, and coagulation kinetic constants. Some characteristic times of the particles formation process are also derived and discussed. (Author abstract modified)

24858 **APTIC NO. 45374**

Fagarash, M. B. and F. B. Moin

PHOTOLYSIS OF THE TRIFLUOROACETIC ACID ANHYDRIDE. *(Fotoliz angidrida triftoruksusnoy kisloty).*

Text in Russian. Kinetika i Kataliz, 13(2):274-278, 1972. 5 refs.

The photolysis of trifluoroacetic acid anhydride was studied at 25-220 C and 40-280 mm Hg. The main products of the photolysis were ethyl hexafluoride, carbon monoxide, and carbon dioxide (formed in largely the same proportions), as well as small amounts of trifluoroacetic fluoride (CF_3COF) and other, nonidentified products. Trifluoromethane formed additionally when methane or pentane was added. Trifluoroacetic acid anhydride was found to be a possible source of trifluorocarbon radicals. The kinetics of the reaction of trifluorocarbon radical with n-pentane was studied to determine the reaction constant for a CF_3 recombination constant of 23 trillion cu cm/mol/sec. The quantum yield of the photolysis, as determined for 150 C and 100 mm Hg, was 0.7, slightly dependent on the temperature and independent of the pressure.

24859 **APTIC NO. 45960**

Fischer, William H. and J. P. Lodge, Jr.

PARTICLE PRODUCTION BY POLYMER PYROLYSIS: MASS SPECTROMETRIC INVESTIGATIONS.

National Center for Atmospheric Research, Boulder, Colo., National Air Pollution Control Administration Research Grant 5-R01AP00944-02, 15p., 1972. 4 refs.

Mass spectrometric techniques were applied in an attempt to elucidate the mechanism by which polymers release condensation nuclei during pyrolysis. The polymers used were a straight hydrocarbon oil, Apiezon C, and polystyrene; argon and argon containing 10 ppm carbon monoxide were the test gases. The polymers were dissolved in a solvent and placed in a converter beaker: the solvent was evaporated to leave a film of polymer approximately 100-150 microns thick. The converter was brought up to working temperature with filtered room air; the appropriate tank gas was then introduced. Any necessary heater correction was applied. A cold U-trap was connected to the line, and the reaction products were collected for about two hours with periodic interruptions to check the nuclei count. Spectrometer scans were made, and the data were processed with a CDC 6600 computer program. In every sample, CO was detected, indicating that the reaction of CO with the polymer is not quantitative. Saturated, branched, and/or oxygenated species were found most often in the samples prepared in Ar-CO, least often in Ar. Saturates were about twice as common as unsaturates. The hydrocarbon oil tended to give more branch and/or oxygenated species and fewer saturates than did polystyrene, with no differences in unsaturates. The makeup of the computed reaction products, however, did not vary significantly as polymers or gases were changed. The makeup of the products was consistent with those to be expected from free radical reactions. The unsuitability of some of the materials and of the computer program library hindered the experiments.

24860 **APTIC NO. 46168**

Fontijn, Arthur and John Lee

COMPARISON OF THE ABSOLUTE QUANTUM YIELDS OF THE GAS-PHASE O/NO REACTION AND THE LIQUID-PHASE LUMINOL OXIDATION CHEMILUMINESCENCE INTENSITY STANDARDS.

J. Opt. Soc. Am., 62(9):1095-1098, Sept. 1972. 17 refs.

Chemiluminescence intensity from the atomic oxygen/nitric oxide gas-phase reaction and from luminol (3-aminophthalhydrazide) oxidation in the liquid phase were measured under the same conditions of geometry, optics, and detection over the wavelength range 440-530 nm. The rate constant for O/NO emission, measured by Fontijn, Meyer, and Schiff, and the luminol chemiluminescence quantum yield, obtained by Lee and Seliger, lead to monochromator photomultiplier calibrations that agree within a factor of 1.09 plus or minus 0.40. The correction factors for refraction and light trapping that have to be considered when comparing liquid to gas-phase luminescence intensities are briefly discussed. (Author abstract modified)

24861 **APTIC NO. 45720**

Gebelein, Helmut and Joshua Jortner

ON THE RELATION BETWEEN NON ADIABATIC UNIMOLECULAR REACTIONS AND RADIATIONLESS PROCESSES.

Theor. Chim. Acta, 25(2):143-168, 1972. 46 refs.

The results of a theoretical study of nonadiabatic unimolecular dissociation processes with application to the decomposition of nitrous oxide (1 Sigma) to yield nitrogen (1 Sigma g) and oxygen (3P) are given. Such unimolecular reactions, which involve a change in the electronic state, can be handled by the theory of thermally excited intramolecular radiationless decay processes in analogy to molecular predissociation and electronic relaxation in the statistical limit. General criteria were advanced for describing the decay probability of a single vibronic level in terms of Fermi s golden rule and for specifying the (high pressure) unimolecular rate constant in terms of a thermally averaged transition probability. The quantum mechanical rate constant for the nonadiabatic reaction is characterized by a preexponential factor determined by the interstate-coupling matrix element and by a temperature-dependent activation energy. At low temperatures the activation energy is equal to the continuum onset, and the reaction involves a tunneling process. In the high-temperature limit a general demonstration of the Franck Condon principle for thermal reactions was provided, whereupon the nonradiative transition occurs at the intersection of the potential surfaces. Numerical calculations for a one-dimensional model system for the thermal decomposition of nitrous oxide were performed utilizing the semiclassical approximation and confirm the general conclusions. A two-dimensional linear model was developed representing the rate constant in terms of a convolution of two generalized line-shape functions, which enabled the study of distribution of vibrational energy among the N_2 molecules resulting from the thermal decomposition of N_2O. Some predictions concerning the determination of single-level decay probabilities and vibrational distribution of the molecular products are presented. (Author abstract modified)

24862 **APTIC NO. 46162**

Hancock, J. K. and W. H. Green

LASER-EXCITED VIBRATIONAL RELAXATION STUDIES OF HYDROGEN FLUORIDE.

J. Chem. Phys., 56(5):2474-2475, March 1, 1972. 9 refs.

Room temperature rates of vibrational deactivation of hydrogen fluoride by HF, argon, nitrogen, deuterium, hydrogen, and carbon dioxide are reported. Laser-induced fluorescence experiments were carried out using a transverse electrode HF chemical laser as a pumping source. The fluorescence signals were monitored with gold:germanium and indium:antimony detectors, which, with the associated electronics, had time responses of 0.25 and 1.0 microsecond, respectively. The energy transfer properties of HF are of great importance in HF and $HF\text{-}CO_2$ (transfer) chemical lasers.

24863 **APTIC NO. 46130**

Hashimoto, Akio

THE ACCOMMODATION COEFFICIENTS OF CARBON MONOXIDE, OXYGEN, AND CARBON DIOXIDE ON PLATINUM.

(Hakkin ni taisuru issanka tanso, sanso oyobi nisanka tanso no tekio keisu). Text in Japanese. Nippon Kagaku Zasshi (J. Chem. Soc. Japan), 93(8):1358-1361, Aug. 1972. 10 refs.

To delineate energy transfer at the gas-solid interface in the catalytic oxidation of carbon monoxide on platinum, the accommodation coefficients of carbon monoxide, oxygen, and carbon dioxide were determined by measuring the heat loss from the platinum ribbon at temperatures of 165-544 C and under gas pressures of .01-.05 torr. For CO, the accommodation coefficient is 0.652 at 165 C, but increases at higher temperatures. For 02, the accommodation coefficient is 0.471 at 165 C and decreases up to about 400 C, and then shows a nearly constant values of 0.39. For CO_2, the accommodation coefficient is 0.482 at 165 C and decreases to 0.354 at 544 C. Since CO_2 is not chemisorbed on platinum, the impinging gas molecules are adsorbed physically on a platinum surface and exchange their energy with the surface, and the accommodation coefficient decreases with increasing ribbon temperature. CO and O_2 are chemisorbed on platinum forming a layer at low temperatures, and most of the energy transfer takes place between this layer and the gas molecules sorbed on it. At higher temperatures, the chemisorbed layer becomes unstable and the energy transfer takes place on the surface. Consequently, the temperature dependence of the accommodation coefficient deviates from that observed at low temperatures.

24864 **APTIC NO. 46057**

Heuss, J. M., G. J. Nebel, and B. A. D Alleva

EFFECTS OF GASOLINE AROMATIC AND LEAD CONTENT ON EXHAUST HYDROCARBON REACTIVITY. *Preprint, American Chemical Society, Washington D. C., 34p., 1972. 14 refs. (Presented at the American Chemical Society, National Meeting, 163rd, Boston, Mass., April 9-14, 1972.)*

The effects of gasoline aromatic and lead content on exhaust hydrocarbon reactivity are presented. The presence or absence of tetraethyl in gasoline has no effect on exhaust hydrocarbon reactivity, but the kinds of aromatics in gasoline have a major effect on those aspects of reactivity associated with eye irritation. Since 1971 and later model cars require lower octane fuels, the gradual removal of lead will require only minimal changes in gasoline composition, and therefore will not affect exhaust hydrocarbon reactivity significantly. On the other hand, selective changes in the aromatic fraction of gasoline in areas experiencing photochemical smog might be useful in reducing eye irritation in those areas. Additional study is needed to determine just what these selective changes should be. The photochemical reactivity from different fuels was measured in a irradiation chamber. Formaldehyde, peroxybenzoyl nitrate, peroxyacetyl nitrate, ozone, acrolein, and nitrogen dioxide were measured.

24865 **APTIC NO. 45678**

Hosemann, Peter J.

THE THEORY OF IONIZATION MEASUREMENT CHAMBERS WITH SPECIAL CONSIDERATION OF THE RECOMBINATION OF SMALL IONS. *(Zur Theorie von Ionisationsmesskammern unter Beruecksichtigung der Kleinionenrekombination). Text in German. Staub, Reinhaltung Luft, 32(7):286-289, July 1972.*

Small ions can accumulate on electrically neutral particles. If small ions are produced between two electrodes of different polarity, it is then possible to measure a stream of ions. As a result of accumulation, this stream decreases when particles penetrate into the space between the electrodes. The ionization measuring chambers operate in the range of stream saturation. In this case the recombination of small ions may be disregarded. An equation was derived to express the electric field of a cylindrical measuring chamber. Under very specific conditions it is possible to construct a measuring chamber which operates very much below the stream saturation and which is free from space charges. From stream measurements carried out by means of such a chamber it is possible to draw conclusions as to the product of particle concentration and average particle diameter.

24866 **APTIC NO. 45664**

Ivanov, A. M.

FORMAL KINETICS OF IRREVERSIBLE CHEMICAL REACTIONS OF SIMPLE TYPES BETWEEN GAS AND LIQUID, TAKING PLACE WITH A CHANGE IN VOLUME. GENERAL CASE OF CALCULATING THE REMOVAL OF LIQUID COMPONENTS WITH OFF-GAS. *(Formalnaya kinetika odnostoronnykh khimicheskikh reaktsiy prostykh tipov mezhdu gazom i zhidkostyu, protekayushchikh s izmeneniyem obyema. Obshchiy sluchay ucheta unosa zhidkikh komponentov s otkhodyashchimi gazami). Text in Russian. Zh. Fiz. Khim., 45(2):359-361, 1972. 4 refs.*

The chemical kinetics and mechanisms in irreversible simple reactions between a gas and a liquid in semicontinuous flow were studied in a bubbling system with corresponding volume change of the liquid phase. Formulae were derived for the calculation of the volume changes occurring due to the removal of the liquid phase by the offgas and through the nonequivalent molar volumes of initial substances and reaction products. The flow volume is, in general, a complicated function of kinetic parameters, stoichiometry, and reaction time. The characteristics of the kinetic curve were not affected by the introduction into the calculations of the gas volume consumed for the chemical reaction. High gas consumptions at uniform flow rates corresponded to high maximum conversion rates under identical reaction conditions.

24867 **APTIC NO. 45734**

Jenkins, D. R.

PROPOSED MODE OF ACTION OF ALKALINE EARTH METALS IN SUPPRESSING SOOT. *Combust. Sci. Technol., 5(5):245-249, July 1972. 9 refs.*

Laboratory tests on the effect of adding mists of aqueous solutions of metal salts on the soot emission from laminar flow propane diffusion flames were carried out. Of the forty metals tested, the alkaline earth metals barium, strontium, and calcium were the most effective. More detailed studies of the chemical effects of the metals on flames have given strong indications that these metals affect soot by an indirect mechanism involving the catalytic dissociation of water vapor to provide hydroxyl radicals. Recombination of excess radicals in premixed hydrogen/oxygen flames and soot reduction in diffusion flames are different aspects of the same catalytic reactions, in the forward and backward directions respectively. Reaction rates can be calculated. (Author abstract modified)

24868 **APTIC NO. 45352**

Kafarov, V. V., V. A. Reutskiy, V. N. Sharifullin, A. B. Tyutyunnikov, and G. M. Rubskaya

A NEW METHOD FOR THE COMPUTATION OF CHEMISORPTION PARAMETERS. *(Novyy metod rascheta protsessov khemosorptsii). Text in Russian. Zh. Prikl. Khim., 45(5):1028-1031, May 1972. 6 refs.*

A simplified method of high accuracy for the computation of chemisorption columns is presented. As homogeneous chemical reactions are considered, no chemisorption rate profiles and column height-related reagent concentration distributions have to be calculated. The concentration of one of the reagents at the ends of the column, and the chemisorption rate for one of the ends of the column should be determined. The changes in the concentration of the active proportion of the reagent in the lower part of the column are assumed to take place according to a homogeneous first-order reaction. The method is suitable for the theoretical and empirical computation of chemisorption columns, including the determination of the number of column plates. Examples of calculation for the absorption of carbon dioxide in sodium hydroxide and potassium hydroxidsolutions, as well as an empirical equation for the determination of the carbonization rate of sodium phenolate solutions are presented.

24869 **APTIC NO. 45642**

Kleymenov, V. I., Yu. V. Chizhov, and F. I. Viselov

INVESTIGATION OF SPONTANEOUS IONIZATION PROCESS IN NITRIC OXIDE BY MEANS OF PHOTOELECTRON SPECTROSCOPY. *(Issledovaniye protsessov avtoinizatsii v okisi azota metodom fotoelektronnoy spektroskopii). Text in Russian. Opt. i Spektroskopiya, 32(7):702-708, April 1972. 13 refs.*

The photoionization of nitric oxide in a spectral range of 1280-900 Angstrom was studied by means of photoelectron spectroscopy. The energy spectra of electrons released during the photoionization of NO at 60 different photon energies were used to determine spectral relationships of the partial sections of photoionization transitions producing vibrationally excited N^+ ions in the principal electron state. Spontaneous ionization processes resulted in a high degree of occupancy of both low and high vibrational levels in the principal N^+ ion state. The distances of the first six adjacent levels were in good accordance with spectroscopic data. Analyses of photoelectron energy spectra and spectral relationships of photoionization partial sections revealed that the distributions of the N^+ ions formed among the different vibrational levels failed to correspond to the distribution observed in direct photoionization transitions in any of the spontaneous ionization bands. This was due to spontaneous ionization which occurs at an intensity exceeding that of direct ionization. Practically no ion formation in the zero vibrational level in spontaneous ionization was observed, and very small probability for the formation of ions excited to the first vibrational level was determined. These facts suggest the possibility that the equilibrium internuclear distances for high-excitation spontaneous ionization states in the spectral range considered may be larger than in the principal state of the NO molecule. Thus, the pure vertical transition may lie either higher than the dissociation level of the NO^+ ion excitation state, or in a shorter-wave spectra range.

24870 **APTIC NO. 45456**

Lang, B., R. W. Joyner, and G. A. Somorjai

LOW ENERGY ELECTRON DIFFRACTION STUDIES OF CHEMISORBED GASES ON STEPPED SURFACES OF PLATINUM. *Surface Sci., 30(2):454-474, April 1972. 22 refs.*

The chemisorption of hydrogen, oxygen, carbon, carbon monoxide, and ethylene was studied by low-energy electron diffraction on ordered stepped surfaces of platinum which were cut at angles less than 10 deg from the (111) face. The chemisorption characteristics of stepped platinum surfaces are markedly different from each other. Hydrogen and oxygen which do not chemisorb easily on the (111) and (100) crystal faces chemisorb readily and at relatively low temperatures and pressures on the stepped platinum surfaces. In contrast to the ordered adsorption of carbon monoxide and ethylene on low index faces, the adsorption was disordered on the stepped surfaces and there is evidence for dissociation of the molecule. Carbon formed several ordered surface structures and caused faceting on the stepped surface, which are not observed on low index platinum surfaces. There appears to be a much stronger interaction of chemisorbed gases with stepped surfaces than with low index planes that must be caused by the differing atomic structures at the steps. Evidence for the differing reactivities of the two stepped surfaces are also discussed. (Author abstract modified)

24871 **APTIC NO. 45403**

Lawrence, E. N.

LARGE AIR-TEMPERATURE LAPSE-RATES NEAR THE GROUND. *Weather (London), 27(1):27-30, Jan. 1972. 7 refs.*

A marked shimmering phenomenon, consisting of narrow bands of dullness moving rapidly across an otherwise highly illuminated piece of white cardboard was observed. The cardboard was lying horizontally on a desk in the sunshine transmitted through a plain glass window. The shimmering could be explained by the changing contrast between densities of the cold outside air, streaming through the window, and the warmer inside air, below the level of the window and above the hot-water pipe. Alternating parcels of cold and warm air could cause corresponding and changing discontinuities at the main interface between the cold and warm air and thus corresponding changes in the refractive index between the two. However, it seems likely also that the two air masses could have an undulating or corrugated interface with parallel lines of waves which act as lenses and tend to concentrate the incident light into bands by refraction. A lapse-rate of temperature of about 500A was calculated, where A is the dry adiabatic lapse-rate of temperature (1 deg C/100m). In the free atmosphere such a large lapse-rate is never even approached. The actual lapse-rate of the free atmosphere seldom exceeds the dry adiabatic value. The large indoor lapse-rate is more akin to outdoor lapse-rates near the ground where exposed to extreme isolation. The shimmering phenomenon suggests that conditions may be unstable even when density increases upwards, that is, even when the lapse-rate is greater than 3.5. The most probable explanation for such high values of lapse-rates is the existence of stability even though the lapse-rate is greater than 3.5A. The transfer of heat from soil to air is only by radiation and conduction, convection being limited to exchange of heat in the atmosphere; the time lag between heating of the soil and heating of the air suggests that a large amount of heat exchange is accomplished through conduction; since the thermal conductivity of air is very small, this high conduction requires the existence of large temperature gradients. In the optical phenomenon under discussion, there was an unusually large super-adiabatic air temperature lapse-rate and vertical shear, but it would seem that viscous forces were sufficient to prevent turbulence from breaking down the vertical temperature structure which was responsible for the observed optical effects.

24872 **APTIC NO. 45372**

Lisachenko, A. A. and F. I. Vilesov

THE MECHANISM OF OXYGEN PHOTOACTIVATION OCCURRING DURING ITS ADSORPTION ON ZINC OXIDE SURFACES. *(O mekhanizme fotoaktivatsii kisloroda, adsorbirovannogo na okisi tsinka). Text in Russian. Kinetika i Kataliz, 13(2):420-425, 1972. 23 refs.*

Photosorption and photocatalytic effects were studied using oxygen with increased oxygen (18) isotope concentration at 0.05 torr pressure in visible ultraviolet light during the adsorption of oxygen on oxidized zinc oxide surface. Isotope exchange during the photosorption at room temperature of oxygen on ZnO was observed. The isotope exchange, taking place at a rate independent of the photosorption effect, was not suppressed by preliminary saturation with O(16) isotopes and showed memory effect for irradiation, which may be due to stabilized excitation states caused by surface defects. The adsorbed oxygen was released on heating at 180 C without changes in the isotopic composition taking place. Readsorption of oxygen in the gaseous phase, accompanied by changes in the isotopic composition, was observed above 180 C. The quantity of adsorbed oxygen at 250 C was the same as originally, without changes in the Fermi levels taking place, after which photodesorption was replaced by photosensitization, accompanied by isotope exchange processes. A close relationship between photosensitization and photocatalytic effects on oxidized ZnO, and lack of correlation between photosensitization and isotope exchange, were observed. The mechanism of oxygen photoactivation is in connection with the excitation of local surface centers formed on the preliminary action of oxygen.

24873 **APTIC NO. 45371**

Maksimov, N. G., V. A. Chigrina, G. K. Boreskov, V. F. Anufriyenko, and T. M. Yur yeva

EPR STUDY OF THE CONDITION OF COPPER INVOLVED IN THE COPPER-MAGNESIUM OXIDATION CATALYST. *(Izucheniye sostoyaniya medi v okisnom mednomagniyevom katalizatore metodom EPR). Text in Russian. Kinetika i Kataliz, 13(2):446-453, 1972. 10 refs.*

The condition of copper ions in copper-magnesium catalysts used for the conversion of carbon monoxide was studied by means of electron paramagnetic resonance spectrometry. The samples, prepared by joint precipitation of copper and magnesium hydroxides, contained 0.1 to 80 atom % of Cu, and were investigated in dry form and at 200-1000 C. EPR spectral analyses revealed the formation of solid solutions with Cu ions substituting magnesium in magnesium oxide, as well as of a copper oxide phase due to dehydration of the hydroxide above 400 C with copper contents exceeding 20 atom %. The proportion of Cu ions in solid solutions increased with temperature to reach practically 100% above 1000 C. Both widely spaced, isolated ions, and ions in solid solutions at temperatures below 400 C were detected. The Cu ion concentrations on the surface of the solid solutions in samples heated to below 1000 C exceeded the volume concentrations of Cu ions by four to six times. Surface ions in solid solutions showed uneven distribution. The bulk of the surface ions was arranged in the form of magnetic associates. Some 20% of all surface ions were isolated by the adsorption of carbon dioxide.

24874 **APTIC NO. 45735**

McArragher, J. S. and K. J. Tan

SOOT FORMATION AT HIGH PRESSURES: A LITERATURE REVIEW. *Combust. Sci. Technol., 5(5):257-261, July 1972. 23 refs.*

A literature survey is presented on the effect of pressure on soot formation in flames. For continuous flames the main effect is an increase in soot formed proportional to the pressure increase. The reverse is true for gaseous explosions, as the soot yield decreases with pressure, presumably because the combustion products have a greater chance to approach equilibrium. Diffusion flames show a low pressure limit below which soot does not occur; for premixed flames the critical fuel/air ratio for soot formation is essentially independent of pressure, although the proportion of tarry materials may vary. Diffusion flames will always give more soot than pre-mixed, especially at high pressures. Turbulence has a considerable effect in reducing soot formation in both types of flames, due to its effect on the mixing of the combustion gases. The size of the carbon particles formed in soot is independent of pressure, but the amount of pure carbon in soot is not. High pressures and weak mixtures favor solid carbon, and low pressures and rich mixtures favor tar. (Author abstract modified)

24875 **APTIC NO. 46167**

McBride, Donald D. and Pauline M. Sherman

CONDENSED ZINC PARTICLE SIZE DETERMINED BY A TIME DISCRETE SAMPLING APPARATUS. *AIAA (Am. Inst. Aeronaut. Astronaut.) J., 10(8):1058-1063, Aug. 1972. 23 refs.*

An investigation was conducted to determine the particle size distribution of solid zinc particles originating through homogeneous condensation of zinc vapor expanding with a helium carrier gas through a supersonic nozzle. Stagnation chamber pressures varied from 2250-4000 psia while chamber temperatures varied from 2350-4000 K. The zinc mass fraction was held at approximately 0.75. The particle sampler, which viscously decelerates the high speed flow emanating from a supersonic nozzle, is an effective means of collecting very small particles while they are still held in suspension in the carrier gas. The measured particle size distribution was in general to be quite narrow with 80% of the particles having diameters within a range of 100 A. The distribution curve peaked at a diameter of 135 A indicating that the majority of particles clustered about that size. The particle size distribution seemed to be relatively insensitive to the superheated stagnation conditions. (Author summary modified)

24876 **APTIC NO. 45680**

Mizuno, K.

DIFFUSION EXPERIMENTS IN A WIND TUNNEL. *(Fudochu ni okeru kakusan jikken). Text in Japanese. Kogai (Hakua Shobo) (Pollution Control), 7(4):160-171, July 1972. 7 refs.*

Model experiments on atmospheric diffusion were conducted in the boundary layer in a wind tunnel in order to determine the effects of ground shape and stack location on smoke concentration. A wind tunnel 4.5 m wide, 1.8 m high, and 22 m long was used for the study. Ethylene was the tracer gas. The stack was a stainless steel tube 1 mm in diameter and bent to resemble the reverse L type. The maximum concentration was higher and the distance to the maximum concentration longer when the stack was on smooth ground. The same maximum concentration was obtained by increasing the height of the stack on smooth ground by a factor of 1/4, regardless of the height of the hill (on which the stack gave lower maximum concentration) on which it was placed. The relation was also estimated by stream function and compared. When no separation of the flow occurred behind the model, the relation could be obtained by the latter method.

24877 **APTIC NO. 46059**

Moilanen, Kenneth and Donald G. Crosby

VAPOR-PHASE PHOTODECOMPOSITION OF PESTICIDES. *Preprint, American Chemical Society, Washington, D. C., 23p., 1972. 10 refs. (Presented at the American Chemical Society, National Meeting, 163rd, Boston, Mass., April 11, 1972.)*

The effect of sunlight on pesticides in air was investigated. A reactor was constructed to simulate atmospheric conditions as closely as possible. A 2.5 in. beam of collimated ultraviolet light is delivered through the center of a 72-liter reaction chamber, saturated with pesticide vapor, and then absorbed by a light trap. The unpainted area at the end of the flask serves as a window and permits the beam of light to leave the reaction chamber and be absorbed by the light trap. The light shield houses the light source and its function is to absorb that portion of the ultraviolet light that does not enter the collimator. The piece of pyrex glass bonded over the end of it prevents pesticide vapor leaving the apparatus, and acts as a filter for the light source. Gas inlet and outlet tubes provide vents to the outside or may be used to circulate air or nitrogen through the reaction chamber. The reflector is a silvered round bottom flask, and replaces the light trap. The collimator transmits 1 watt of power and absorbs 2 watts. To check the effectiveness of the reactor, a model was first studied. Dieldrin was considered an ideal model compound. From the results of the preliminary work on the vapor-phase photo- decomposition of pesticides, the model proves to be a good simulation of the atmosphere. (Author conclusions modified)

24878 **APTIC NO. 46161**

Nakakuki, Atsushi

COALESCENCE OF SPRAY DROPS IN COMPRESSED ATMOSPHERES. *Preprint, American Society of Mechanical Engineers, New York, 3p., 1972. 3 refs. (Presented at the American Society of Mechanical Engineers, Gas Turbine and Fluids Engineering Conference and Products Show, San Francisco, Calif., March 26-30, 1972, Paper 72-FE-13.)*

The test result on some spray properties is reported for various types of nozzles, and how the coalescence occurs is discussed. The Sauter mean diameter and the pattern of the water spray injected into the compressed air vertically downwards were measured. For the spray with a comparatively large ratio of the equivalent spray angle at atmospheric pressure to that at any ambient pressure, the rate of increase of the Sauter mean diameter with any ambient pressure increased with the ratio, and the Sauter mean diameter increased with the distance from the nozzle. The Sauter mean diameter for the spray of very small ratio decreased with increasing ambient pressure. These phenomena are explained by the coalescence of drops. (Author abstract modified)

24879 **APTIC NO. 46154**

Nakata, Kiyoshi, Jun Emi, and Chikao Kanaoka

FLOW ANALYSIS OF POROUS FILTER AND PARTICLE INERTIA COLLECTION RATE. *(Takoban firuta o sugiru nagare no kaiseki to ryushi kansei hoshu koritsu). Text in Japanese. Preprint, Japan Society of Chemical Engineering, Tokyo, p. 204-206, 1972. 3 refs. (Presented at the Japan Society of Chemical Engineering, Annual Meeting, 37th, Nagoya, Japan, 1972.)*

The study of flow analysis of the porous filter and particle inertia collection rate was made using the results of calculation of the Navier-Stokes equation for axial-symmetric flow. Navier-Stokes equations for analysis of the axial-symmetic flow are presented with mathematical equations. The results of flow function and eddy degree in a uni-porosity model are presented. The flow which passes through uni-porosity was obtained mathematically and the validity was checked with experimental data. The particle collection rate of uni-porosity was determined. The movement of particles is presented in a co-ordinate system with mathematical equations. The velocity of the flow of each point was obtained by flow function and a particle locus was found. The results are presented on a graph.

24880 **APTIC NO. 46274**

Okita, Toshikazu

THE FORMATION MECHANISM OF PAN AND ITS MEASUREMENT METHOD. *(PAN-to no hassei kiko to sono sokuteiho). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 63-70. 10 refs.*

The formations of various gases by photochemical reaction and the methods for the measurement of peroxacetyl nitrate (PAN) and its analogs are described. Peroxacetyl nitrate results from the reaction of acetaldehyde, oxygen, and nitric anhydride or other hydrocarbons and nitrogen dioxide or nitric oxide and the reaction does not occur before ozone is formed. The PAN can be detected by gas chromatography with an electron capturing detector. Results of colorimetric determination after it is absorbed in 5% caustic soda are consistent with those from infrared and nuclear magnetic resonance methods. The infrared absorptivities of PAN, peroxypropionyl nitrate, peroxy-n-butanoyl nitrate, and peroxybenzoyl nitrate are tabulated.

24881 **APTIC NO. 45386**

Paraskevopoulos, G., V. B. Symonds, and R. J. Cvetanovic

RELATIVE RATE OF REACTION OF O(1D2) WITH N2O. *Can. J. Chem., 50(12):1838-1842, June 15, 1972. 20 refs.*

The rate of reaction of O(1D2) with nitrous oxide relative to the rate of its reaction with neopentane was determined by a competitive method. The technique used is based on measurements of the decrease in the yield of neopentanol, the main product of the reaction of O(1 D) with neopentane, when other gases compete with neopentane for O(1D). The value obtained, kN2O/kneop. equals 0.145 plus or minus 0.010, is in good agreement with several values in the literature. Nitrous oxide did not deactivate O(1D2) to O(3P) but reacted with it to form products. (Author abstract modified)

24882 **APTIC NO. 45676**

Portscht, Rainer

CALCULATION AND MEASUREMENT OF EXTINCTION PROPERTIES OF SMOKE IN THE OPTICAL SPECTRAL RANGE. *(Berechnung und Messung der Extinktionseigenschaften von Rauch im optischen Spektralbereich). Text in German. Staub, Reinhaltung Luft, 32(7):277-285, July 1972. 46 refs.*

Optical smoke detectors, extinction measuring instruments, heat locators, flame radiation detectors in a smoky atmosphere, and optical data transmission are mentioned. The extinction properties of smoke in the range of the optical wavelengths are discussed. With the aid of calculation results by the Mie theory, the influence of the particle diameter or the particle size distribution parameters, of the wavelength, of the index of refraction and absorption, and of the particle concentration on the extinction properties of smoke is examined. The properties were predicted by calculations and confirmed by suitable measurements of the spectral transmission factor. Smoke of petroleum products, the disperse phase of which consists of soot particles, and smoke of substances containing cellulose, with liquid particles, were found. The parameters of the particle size distribution were measured for both kinds of smoke.

24883 **APTIC NO. 45708**

Pozlovskiy, A. I. and V. A. Gryaznov

QUASI-RADICAL REACTIONS OF NITROGEN OXIDES. *(O kvaziradikalnykh reaktsiyakh okislov azota). Text in Russian. Kinetika i Kataliz, 13(1):215, Jan./Feb. 1972. 3 refs.*

The behavior of the ethylene-nitrogen dioxide, butadiene-nitric oxide, acetylene-nitric oxide, and acetylene-nitrogen dioxide systems under specified conditions of concentrations, temperatures, and reaction rates was studied for the possibility of quasi-radical reactions. No remarkable reactions of these mixtures occurred. Rapid low-temperature quasi-radical reactions of the systems butadiene-NO2 and ethylene-NO were observed in former experiments. The possibility of the rapid reactions of NO2 at low concentrations apparently constitutes a specific feature of butadiene-NO2 mixtures.

24884 **APTIC NO. 45746**

Punjrath, J. S. and D. R. Heldman

INFLUENCE OF AIR TURBULENCE ON RE-ENTRAINMENT OF SMALL PARTICLES FROM FLAT SURFACES. *Trans, ASAE (Am. Soc. Agr. Engrs.), 15(3):559-562, May-June 1972. 9 refs. (Presented at the American Society of Agricultural Engineers, Annual Meeting, Minneapolis, Minn., July 1970, Paper 70-376.)*

The re-entrainment of small particles from surfaces is important in industries concerned with air-borne contamination. Re-entrainment forces are fluid dynamic, inertial (centrifugal, vibrational, or gravitational), or from direct machanical contact (brushing and grinding). Aerodynamic forces cause re-entrainment due to air flow. The relative humidity of ambient air has a significant influence on the force of adhesion between a praticle and a surface. Therefore, experiments were performed at nearly equal relative humidities (in the range of 36-40%). A settling chamber was used in which a uniform cloud of dust was generated by a dust cloud generator system. Spherical glass shot particles were divided into fractions 0-10, 10-20, 15-30, and 20-40 micron in size. The method of deposition had a significant influence on the ease of particle re-entrainment. The re-entrainment studies were performed in a low speed, open return wind tunnel. The distance from the leading edge of a flat surface at which particle re-entrainment initiates decreased as free-stream velocity or intensity of turbulence increased causing higher re-entrainment. Low air velocity caused significant amounts of particle re-entrainment when the surfaces were sufficiently long in the direction of air flow. There was a close analogy between the influence of turbulence on re-entrainment and the phenomenon of transition of flow in the boundary layer overr a flat plate at zero angle of incidence. Particles from 15 to 22.5 micron in diameter required minimum force per unit area for re-entrainment from a surface. Particles near the leading edge of a flat surface were more difficult to remove than particles near the downstream edge. The use of a drag coefficient of a particle immersed in a free-stream of air in the re-entrainment studies was not justified. The aerodynamic drag coefficient should also reflect the influence of distance from the leading edge, as well as the influence of intensity of turbulence and contact with the surface. (Author conclusions modified)

24885 **APTIC NO. 46123**

Rasmussen, C. G. and J. Damsgaard Jensen

DOPPLER ANEMOMETRY WITH A LASER DETECTOR. *(Anemometrie Doppler a laser). Text in French. Entropie, no. 44:47-53, March-April 1972. 4 refs.*

The problem of the continuous detection of the Doppler frequency necessary to obtain analogous representation of the speeds of suspended particles in, and of, fluids, and the design of a frequency detector are discussed. The detection of the Doppler frequency is possible by means of heterodyne optical methods, or of a combination of two different heterodyne techniques. The Doppler signal flowing from the photodetector is both modified in its frequency and amplitude, and mixed with superimposed noise. The instantaneous value of the Doppler frequency, necessary for the determination of the instantaneous value of the velocity vector, is obtained by means of a special automatic detector, in which the signal is sent through a low-pass filter after amplification, filtration, and mixing. The frequency detector, serviceable also under unfavorable conditions such as produced by very low and highly variable particle concentrations, allows turbulent speed variations to be measured, which is demonstrated by measurement of the oscillatory flow produced by extensions of vortices. Laser anemometry can be applied to transparent gases and liquids containing particles of 0.1-10 micron, to measurements in boundary layers and narrow paths, as well as to bi and tridimensional and high-intensity turbulence problems.

24886 **APTIC NO. 45547**

Schiff, H. I.

LABORATORY MEASUREMENTS OF REACTIONS RELATED TO OZONE PHOTOCHEMISTRY. *Ann. Geophys., 28(1):67-77, Jan./Feb./March 1972. 83 refs. (Presented at the International Association of Geomagnetism and Aeronomy, Aurora and Airglow Symposium, Moscow, USSR, Aug. 1971.)*

The ultraviolet photolysis of ozone in the strong Hartley band region produces singlet oxygen atoms and molecules. Although it is likely that the primary quantum yield of the singlet oxygen atom is unity near the peak of the absorption, considerable uncertainty remains about its value near or beyond the long and short wavelength thresholds. Photolysis at 254 nm produces singlet oxygen molecules with near unit efficiency. The reaction of O(1-D) with ozone is fast and gives rise to products capable of further reactions with 03. The identity of these products has not been established but it is unlikely that they lead to energy chains in dry ozone. The reaction of O(1-D) with molecular oxygen produces predominately 02(1-Sigma), which also reacts rapidly with 03. O(1-D) is rapidly quenched by carbon dioxide by probably dose not form a long-lived carbon trioxide molecule. The activation energy of ground state O-atoms with 03 has an activation energy of about 4.2 kcal/mole and leads to vibrationally excited O2, which does not decompose O3 at moderate pressures. The presence of water vapor leads to chain decomposition of O3 under conditions of steady ultraviolet radiation but not in flash photolysis. O(1-D) reacts rapidly with water to produce the hydroxy radical with up to two quanta of vibrational excitation, which do not appear to react rapidly with O3, although highly vibrationally excited positively and negatively charged OH do react with OH with rate constants between 2 and 7 times 10 to the minus 12th power cu cm/molecule/sec. (Author abstract)

24887 **APTIC NO. 46075**

Schoonheydt, R. A. and J. H. Lunsford

INFRARED SPECTROSCOPIC INVESTIGATION OF THE ADSORPTION AND REACTIONS OF SO2 ON MGO. *J. Catalysis, 26(2):261-271, Aug. 1972. 15 refs.*

The mechanism of sulfur dioxide adsorption and reactions on a magnesium oxide catalyst was examined. Sulfur dioxide adsorbs chemically on MgO at room temperature. The adsorbed species transforms to two forms of sulfite surface species (SO3(2-)) after heating at 300 C under vacuum. Above 500 C these species are unstable and either react further or desorb; only a sulfate species (SO4(2-)) remains on the surface. Upon heating in oxygen, the sulfite species react with oxygen to form bidentate and chelate sulfato complexes along with strongly bonded sulfur trioxide. (Author abstract modified)

24888 **APTIC NO. 45605**

Schuck, E. A., E. R. Stephens, M. A. Price, and K. R. Darnall

REACTION OF PEROXYACETYL NITRATE WITH NITRIC OXIDE. *Preprint, California Univ., Riverside Statewide Air Pollution Research Center, 31p., March 16, 1972. 5 refs.*

The reactions responsible for atmospheric oxidation of nitric oxide to nitrogen dioxide are not well understood. Presumably, some intermediate of hydrocarbon photooxidation is involved in this oxidation. In this investigation, the reaction of NO with peroxyacetyl nitrate resulted in formation of NO2. The reaction mechanism is complex; the end result is oxidation of more than one molecule of NO as well as the formation of NO2 from the PAN molecule. The rate of this reaction is approximately 1000 times faster than the rate of the reaction between NO and oxygen to form NO2. Extrapolation of this date suggest that reaction of NO with PAN and its homologues contribute substantially to the observed conversion of nitric oxide to nitrogen dioxide in ambient atmospheres. (Author abstract modified)

24889 **APTIC NO. 46079**

Shin, Hyung Kyu

TEMPERATURE DEPENDENCE OF VIBRATIONAL TRANSITION PROBABILITIES FOR O2, N2, CO, and CL2 IN THE REGION BELOW 300 K. *J. Chem. Phys., 57(3):1363-1364, Aug. 1, 1972. 13 refs.*

As a continuation of earlier work on vibrational relaxation of carbon monoxide and helium at low temperatures, studies were made on the temperature dependence of vibrational transition probabilities for oxygen-oxygen, nitrogen-nitrogen, carbon monoxide-carbon monoxide, and chlorine-chlorine in the region below 300 K by use of the Morse potential in the WKB formulation. The collision number (Z10) for O2 was 6.22 times 10 to the 7th power at 300 K. For N2 Z10 was 8.81 times 10 to the 8th power at 476 K. The observed Z10 for chlorine was 40,000 at 303 K, whereas the calculation gives 12,000. For carbon monoxide it was 1.81 times 10 to the 10th power at 296 K. Although a larger discrepancy was found for Cl2, calculated values are in satisfactory agreement with experiment. At temperatures below 300 K, the molecular attraction makes an important contribution to the efficiency of vibrational energy transfer. The transition probability at temperatures below 300 K seriously deviates from the linear relation of log P10(T) vs. T/(113) due to the important contribution of molecular attraction. For diatomic molecules such as O2, N2, and CO there are weak attractive forces acting between the colliding molecules. The forces are strong enough to increase the efficiency of vibrational energy transfer by one or two orders of magnitude in 100 to 300 K. The use of purely repulsive potentials for the calculation of vibrational transition probabilities is therefore totally inadequate. The simple lowering of repulsive potentials by the depth of the potential well is not satisfactory.

24890 **APTIC NO. 45687**

Simonaitis, R., Eduardo Lissi, and Julian Heicklen

ON THE PRODUCTION OF N2O FROM THE REACTION OF O(1D) WITH N2. *J. Geophys. Res., 77(22):4248-4250, Aug. 1, 1972. 11 refs.*

The source of nitrous oxide in the earth s upper atmosphere is still an unsolved problem. Experiments were done with the incident radiation coming from a filtered mercury resonance lamp so that the only effective wavelength was at 2537 A.

Ozone at 5 to 12-torr pressure was photolyzed for 9 to 24 hours in the presence of 31 to 155 torrs of oxygen and 870 to 1050 torrs of nitrogen. The purpose of the added oxygen was to reduce the net rate of ozone consumption. In six experiments, no nitrous oxide above that present as background (0.3 micron) was observed. Consequently, the upper limit for the nitrous oxide yield was approximately 0.3 micron. To be certain that small amounts of nitrous oxide are not lost during analysis, control experiments were done in which several micron of nitrous oxide were added to a gas mixture identical to that of an actual run. Complete recovery of the added N2O was achieved. Finally, 10.5 micron of N2O was added to a mixture of ozone, oxygen, and nitrogen (13.5, 42, and 880 torrs), and photolyzed for 24 hours to be certain that N2O was not consumed by the oxygen(1D) atoms produced from ozone photolysis. No loss of N2O occurred. Consequently, N2O consumption for N2O pressures less than or equal to 10 micron via those reactions is not important. Nitrous oxide was not a product. From the detectability limit for N2O (0.3 micron) an upper limit to the efficiency of the first reaction relative to the second of .0000025 at 1000-torr total pressure was computed. This value corresponds to k1/k2 less than 0.8 times 10 to the -25th power cu cm/particle.

24891 **APTIC NO. 46229**

Simonaitis, R. and Julian Heicklen

THE REACTION OF OH WITH NO2. *Pennsylvania State Univ., University Park, Ionosphere Research Lab., National Aeronautics and Space Administration Grant NGL 39-009-003 and National Science Foundation Grant GA-12385, Rept. PSU-IRL-SCI 380, 21p., Feb. 22, 1972. 20 refs.*

The reaction of the hydroxyl radical with nitrogen dioxide may play an important role in the stratospheric ozone balance due to conversion of nitrogen oxides, present naturally and introduced as pollutants by supersonic transport aircraft, to nitric acid which eventually appears as nitrate in rain water. This reaction is probably also important in polluted air where it may be an important chain terminating step of nitric oxide to nitrogen dioxide conversion chains carried by the OH radical. Because of the importance of this reaction to atmospheric chemistry and the lack of considerable kinetic data regarding this reaction, a detailed kinetic study was undertaken in which OH radicals were generated by the photolysis of NO2 with 2288 A radiation in the presence of carbon monoxide and water mixtures. (Author introduction modified)

24892 **APTIC NO. 45648**

Snow, M. R., J. McDonald, F. Basolo, and James A. Ibers

A NEW MODE OF SULFUR DIOXIDE ATTACHMENT TO HALOGENATED TRANSITION METAL COMPLEXES. *J. Am. Chem. Soc., 94(7):2526-2529, April 5, 1972. 14 refs.*

A study of the adduct Pt(PPh3)CH3-SO2 was made to investigate sulfur dioxide reactions with metal complexes, the adduct of platinum complexes serves as a good structural model for the halide complexes, and provides a warning that SO2 may attach to sites other than the metal of metal complexes. Liquid sulfur dioxide dissolves the platinum complex giving a yellow solution. Evaporation of the solution yields yellow crystals, analysis of which agrees with that of the nonadduct. On exposure to air, the adduct reverts to pale cream at a rate dependent on crystal size. The larger powder crystals stay yellow for weeks exposed to air. The same yellow triclinic crystals were obtained from a benzene solution saturated with sulfur dioxide. The absorption corrected data gave 0.027 on full-matrix least-squares refinement. The iodine to sulfur distance is significantly shorter than the van der Waals radii sum (3.80 A) but longer than their single bond covalent radii sum (2.37 A). The angle oxygen-sulfur-oxygen is 116.1, and the iodine-sulfur vector makes an angle of 21.3 with the normal to the sulfur dioxide plane. This orientation of the sulfur molecule resembles that in other adducts, such as iridium. The stronger bonds are consistent with larger shifts of their sulfur-oxygen infrared stretching frequencies. Intense absorptions occur in spectra of the bromide and chloride salts progressively shifted to higher energies. It was anticipated that the spectral results would be unaffected by reasonable variation of the groups on the platinum center. The hypothetical SO2 insertion compound PtI(SO2CH3)(PPh3)2 was not formed on adding SO2 to the adduct. The chloro species Pt(PPh3)2(SO2CH3)Cl formed from Pt(PPh3)4 and CH3SO2Cl has a distinctly different infrared spectrum from Pt(PPh3)2CH3I-SO2. It is not possible to eliminate from consideration the unknown five-coordinate platinum (II) species O2S-Pt(PPh3)2CH3I on this basis, according to the comparison of the spectra of compounds PtCl(SO2CH3)(PPh3)2 and O2S-Ir(PPh3)2(CO)Cl.

24893 **APTIC NO. 45758**

Stanislaus, A., M. J. B. Evans, and R. F. Mann

THE KINETICS OF ADSORPTION OF CARBON MONOXIDE ON ALUMINA. *J. Phys. Chem., 76(17):2349-2352, Aug. 17, 1972. 20 refs.*

The kinetics of carbon monoxdie adsorption on alumina and the effects on adsorption of preadsorbing ammonia and water vapor and of reducing the surface prior to adsorption were investigated. The rate of adsorption was measured in the temperature range 151-295 C by measuring the decrease in pressure in a closed system as a function of time. Analysis of the results using the Elovich equation concluded that two distinct adsorption processes occur. The effects of preadsorbed ammonia and water vapor and of reducing the surface with hydrogen and CO suggest that surface hydroxyl groups and surface oxide ions are the most probable adsorption sites. (Author abstract modified)

24894 **APTIC NO. 45841**

Streeter, Robert C.

A COMBUSTION BOMB METHOD FOR THE DETERMINATION OF MERCURY IN COAL. *Preprint American Chemial Society, Washington D. C., Div of Fue Chemistry, 10p., 1972. 7 refs. (Presented at the American Chemical Society, Division of Fuel Chemistry, Symposium on Modern Methods of Fuel Analysis, Boston, Mass., April 12, 1972.)*

A procedure for the determination of nanogram quantities of mercury in whole coal is examined. The method involves decomposition of the coal in a combustion bomb under 24 atm of oxygen in the presence of a nitric acid solution containing hydroxylamine hydrochloride. Following combustion, the contents of the bomb are diluted to a known volume, and mercury is determined by a flameless atomic absorption technique involving stannous chloride reduction. The apparatus, experimental procedures, and test results are reviewed.

24895 **APTIC NO. 46143**

Suzuki, Shin and Nobutoshi Horiuchi

OXIDATION REACTION OF SULFUR DIOXIDE IN THE AIR. *(Taikichu ni okeru aryusan gasu no sanka hanno). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 8(5):271-285, May 1972. 43 refs.*

The relation between the spectrum of the sun s rays and absorption of sulfur dioxide was discussed. There are three absorbing spectrum bands for SO2 gas which are 3800-3400 A, 3200-2400 A and 2400-1800 A. Various kinds of reaction mechanisms between SO2 and oxygen are discussed with chemical and mathematical formula. The production process of sulfur trioxide, sulfates, and ozone are explained. The reaction quantum, phi, has been obtained theoretically and experimentally. The spectral analysis of the SO2 and O2 components are compared and shown on tables. The reaction velocity parameter, K, has been determined with different values; 13 studies are compared. The factors which affect the value of K are: intensity of light, metal oxidization components, and nitrogen oxides plus hydrocarbons. The study of the aftereffect photochemical reaction is introduced. The properties of SO2 are discussed relating to concentration and time of light exposure. The oxidation of SO2 in mist is discussed. The reaction of SO2 and nitrogen dioxide is discussed and the SO2-NO2-air system photochemical reaction production and heavy sulfur kalium are compared concerning the infrared absorbing spectrum. The effect of NO2 on photooxidation of SO2 gas is presented on a graph.

24896 **APTIC NO. 46375**

Suzuki, Shin

A GENERAL DISCUSSION - AIR POLLUTION FORMATION MECHANISM BY PHOTOCHEMICAL REACTION. *(Sosetsu. Kokagaku hanno ni yoru taiki osen no hassei no mekanizumu). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 3-34. 56 refs.*

The identification of ozone, the formation of smog, the photooxidation of nitric oxide to nitrogen dioxide, the formation of O3 from NO2, the formation of aerosols in air, the smog reaction and sulfur dioxide and humidity, the conditions for photochemical smog occurrence, the formation of peroxyacetyl nitrate (PAN), and the singlet excitated state of oxygen are discussed. The rates of ozone formation by irradiating various organic acids or other organic compounds with nitrogen oxides are listed. The effects of SO2 concentration, propylene concentration, NOx concentration, humidity, temperature, and the photochemical reactions on aerosol formation are shown graphically. The smog formation mechanism of the Los Angeles type is also demonstrated.

24897 **APTIC NO. 45713**

Terebenin, A. N. and A. P. Bykov

AEROSOL SEDIMENTATION MECHANISMS OCCURRING IN WATER VAPOR DIFFUSION FIELDS. *(Mekhanizm osazhdeniya aerozoley v pole diffuzii vodyanogo para). Text in Russian. Zh. Prikl. Khim., 45(5): 1012-1015, May 1972. 8 refs.*

Different aerosol sedimentation mechanisms occurring in water vapor diffusion fields were studied in a vertical plane-parallel canal into which dusty, vapor-supersaturated air and tin aerosol were admitted. When the air was cooled from 70 to 14 C, water vapor condensed on nuclei and walls, while no intense nucleation at supersaturations below 2% was observed. At the same time, increase of aerosol particle radius due to condensation was observed, but the particles were too small with 2-4 micron to sediment by gravity or inertia. Since practically all drops approaching the laminar underlayer due to turbulent pulsations deposited on the canal walls, the aerosol sedimentation in water vapor diffusion fields is primarily due to diffusive forces. The probability of penetrating the laminar underlayer due to transverse pulsations was higher for large than for small drops. The contributions of thermodiffusion and diffusive phoresis to the sedimentation of aerosol particles were negligible. Sedimentation in water vapor diffusion fields can be also applied to highly dispersed aerosols.

24898 **APTIC NO. 45754**

Thompson, D., T. D. Brown, and J. M. Beer

NOX FORMATION IN COMBUSTION. *Combustion Flame, 19(1):69-79, 1972. 10 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, Atlantic City, N. J., Aug. 1970.)*

Nitric oxide formation in the flame and post-flame gases of a lean methane-air flame (7.3-9.2% methane) was studied in a 2.54 cm tubular combustor with a multiport flameholder. Nitric oxide formation was substantially unchanged by the introduction of combustion driven oscillations within the frequency range 500-1250 Hz and peak-to-peak pressure amplitudes of up to 1 psi, when relatively low amplitude temperature oscillations were associated with the oscillatory combustion. Superequilibrium concentrations could be calculated from the ratio (H2)/(H2)eq in the fuel-lean system. A modified chain rate equation was used to predict NO formation in the post-flame gases of fuel-lean hydrocarbon flames above 1800 K and gave satisfactory agreement with experimental results.

24899 **APTIC NO. 45733**

Tompkins, Harland G.

THE INTERACTION OF NO2 WITH A TIN-LEAD ALLOY. *Surface Sci., 32(2):296-277, Aug. 1972. 8 refs.*

The interaction of nitrogen dioxide with a tin-lead alloy at room temperature was studied using microbalance techniques. The reaction product was lead nitrate. Film growth kinetic data are presented. The film growth obeys a linear rate law and the limiting factor at constant relative humidity is gas phase diffusion of the NO2. Relative humidity has a strong effect on the growth rate; it gives high growth rates for intermediate relative humidities (20-40%) and low growth rates for very low and for very high relative humidities. The possibile mechanisms of the interaction are discussed, and a process where competitive chemisorption of NO2 and water takes place is postulated. (Author abstract modified)

24900 **APTIC NO. 46180**

Wallis, G. B. and D. A. Sullivan

TWO-PHASE AIR-WATER NOZZLE FLOW. *Preprint, American Society of Mechanical Engineers, New York, 7p., 1972. 13 refs. (Presented at the American Society of Mechanical Engineers, Gas Turbine and Fluids Engineering Conference and Products Show, San Francisco, Calif., March 26-30, 1972, Paper 72 FE-35.)*

An experimental investigation of two-phase, air-water nozzle flows, including critical or choked flow, is described. Five different nozzle geometries were used. The nozzles exhausted to atmospheric pressure from stagnation pressures of 16-55 psia. The quality (mass fraction of air flowing) ranged from 2-35%. A feature of the study was the injection system which was designed to minimize the entrainment of liquid into the gas phase. Separated flow theory, modified by a simple empirical blockage factor, can usefully describe gas-liquid nozzle flows when the two phases are separated in a plenum chamber before entering the nozzle. If mixing occurs in the plenum chamber and is not suppressed in the nozzle the results tend to move toward the predictions of homogeneous flow theory. Two-phase gas-liquid flows occur in atomization and spraying equipment, in the simultaneous flow of oil and natural gas, and in numerous chemical plant applications in which the two phases are contacted in order to promote mixing or chemical reaction. Many industrial thermodynamic cycles involve two-phase flows of a liquid and its vapor over the complete range of quality, from pure liquid to pure gas flows. Nozzle flows occur in control or throttling valves, metering equipment and, inadvertently, in accident situations when a pressure vessel is punctured. (Author abstract modified)

24901 **APTIC NO. 45755**

Wampler, Fred B., Abraham Horowitz, and Jack G. Calvert

MECHANISM OF CARBON DIOXIDE FORMATION IN 3130-A IRRADIATED MIXTURES OF SULFUR DIOXIDE AND CARBON MONOXIDE. *J. Am. Chem. Soc., 94(16):5523-5532, Aug. 9, 1972. 18 refs.*

The mechanism of carbon dioxide formation in sulfur dioxide-carbon monoxide mixtures irradiated within the first singlet absorption band (2400-3200A) was studied. The quantum yields of SO2 triplet-sensitized phosphorescence in biacetyl were determined in SO2-CO-biacetyl mixtures. Kinetic analysis determined the fraction of the excited SO2 singlet molecule

(1SO2) which generates the emitting triplet (3SO2) on undergoing quenching collisions with CO: 1SO2 + M yields (SO2-M or products); 1SO2 + M yields 3SO2 + M; k2/(k1 + k2) equals 0.017 + or 0.010, where M equals CO. The corresponding ratio for M equals nitrogen is 0.033. There is an additional source of SO2 triplets in experiments above 5 Torr of reactants. As a result of these two effects, the rate of triplet formation is increased markedly on the addition of N2 to an SO2-CO mixture. Quantum yields of CO2 formation were determined in 3130-A irradiated SO2-CO mixtures at different CO and SO2 reactant pressures and 0with added benzene and N2 gases. The kinetics of the C6H6-inhibition experiments were consistent with the involvement of the excited fluorescent singlet and the phosphorescent triplet SO2 molecules in the SO2 formation reactions. (Author abstract modified)

24902 **APTIC NO. 45745**

West, Neil L.

AERODYNAMIC FORCE PREDICTIONS. *Trans. ASAE (Am. Soc. Agr. Engrs.), 15(3):584-58[illegible], May-June 1972. 25 refs. (Presented at the American Society of Agricultural Engineers, Annual Meeting, Minneapolis, Minn., July 1970, Paper 70-334.)*

The effects of aerodynamic drag on argicultural material were measured under controlled conditions. The conditions were then simulated using various methods of calculation to determine which method would best simulate the results of the experimental tests. The best utilizing the sphericity concept method was that of defining the shape of the particles by a surface area ratio. This ratio was then used to define the drag coefficient as a function of the Reynolds Number. The complete range of experimental results could be accounted for by considering the variance in particle weight, density, and frontal area. The analytical model using the sphericity concept predicted the aerodynamic forces on agricultural material more accutately than other methods reported in previous research. The described model would be dependable as a simulation device for grain harvesting and handling equipment provided material interaction is not a dominant factor. The same approach could also be used to study drift of material that is spread in a cross wind, or any other simulation problem involving aerodynamic forces on irrgeular particles.

24903 **APTIC NO. 45414**

Westenberg, A. A. and N. deHaas

RELATIVE RATE CONSTANTS FOR O + HCO YIELDS OH + CO AND O + HCO YIELDS H + CO2. *J. Phys. Chem., 76(16):2215-2216, Aug. 3, 1972. 9 refs.*

An analysis is presented showing how the measurement of oxygen atoms consumed and carbon dioxide formed in the O + H2CO reaction system, with (O)O greater than (H2CO)O, can be related to the rate constant ratio for the alternate pathways O + HCO yields OH + CO and O + HCO yields H + CO2. Experimental results in a fast-flow system at room temperature give the value 0.73 plus or minus 0.15.

24904 **APTIC NO. 45727**

Wurster, Walter H.

EXPERIMENTAL STUDIES OF PHOTOIONIZATION PROCESSES IN AIR. *Cornell Aeronautical Lab., Inc., Buffalo, N. Y., Advanced Research Projects Agency Contract N00014-71-C-0387, Program 000001E20K21, ARPA 1479(3/3-11-71), CAL Rept. AI-3107-A-1, 30p., Feb. 1972. 16 refs.*

NTIS: AD 737733

The role of nitric oxide in the nonequilibrium vacuum ultraviolet (VUV) radiation from shock-heated air was investigated using a splitter-plate shock tube technique where the VUV radiation behind a reflected shock was used as a light source to measure the absorption by gases processed only by the incident shock wave. Nitric oxide concentration in combination with the wavelength-dependent absorption coefficient determined the degree of absorption due to nitric oxide taking place in the test gas. The ratio of nitrogen molecule concentration to that of the NO concentration existing behind the incident shock wave reached a maximum at shock speeds near 13,000 ft/sec. With decrease of nitrogen, the resultant nitrogen/NO ratio also decreased. Complete data on methodology, instrumentation, and experimental results to establish testing parameters are presented.

24905 **APTIC NO. 46268**

Yamaki, Naoomi

QUESTION AND ANSWER: THE INITIAL FORMATION OF AIR POLLUTION BY PHOTOCHEMICAL REACTION AND ITS MEASUREMENT TECHNIQUE. *(Shitsugi oto - kokagaku hanno ni yoru taiki osen no hasse: kyo oyobi sokutei gijutsu). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 101-107.*

Questions and answers on the mechanism of photochemical smog formation, the effects of various factors on its occurrence, and the products formed by the reaction are given. Atomic oxygen and ozone react rapidly with hydrocarbons and the oxygen molecule reacts slowly. However, it has been proposed that in a highly reactive singlet state O2 might exist and react very rapidly with hydrocarbons. Benzene is considered inert to photochemical reaction. Mono or poly-substituted benzene becomes active and forms oxidants in air. The correction factors for the measurement of nitrogen dioxide and nitric oxide by the potassium iodide method, ferrous thiocyanate method, and the method for the detection of hydrogen peroxide are discussed.

1971

24906 **APTIC NO. 45588**

Bailey, B. W. and F. C. Lo

COLD VAPOR ATOMIC ABSORPTION DETERMINATION OF MERCURY IN COAL. *J. Assoc. Offic. Anal. Chemists, 54(6):1447-1448, Nov. 1971. 1 ref.*

A method for the determination of mercury in coal is described. The procedure involves combustion of the coal sample in an oxygen atmosphere and collection of the liberated mercury in an acid permanganate solution. The mercury in the solution is determined by cold vapor atomic absorption spectrophotometry. (Author abstract modified)

24907 **APTIC NO. 45591**

Bartok, William, Victor S. Engleman, and Eduardo G. del Valle

LABORATORY STUDIES AND MATHEMATICAL MODELING OF NOX FORMATION IN COMBUSTION PROCESSES. (FINAL REPORT). *Esso Research and Engineering Co., Linden, N. J., Government Research Lab., Office of Air Programs Contract CPA 70-90, APTD-1168, Rept. GRU.3GNOS.71, 147 p., Dec. 31, 1971. 37 refs.*

NTIS: PB 211480

The basic factors affecting nitrogen oxide formation in the combustion of fossil fuels were investigated and modelled using a jet stirred combustor for NOx formation under kinetically limited conditions and a multiburner to determine the influence of heat losses and residence time on NOx emission in the combustion of methane/air. The multiburner was also used as a rudimentary flow reactor to study the formation of NOx in air at high temperatures. At the very short residence times prevailing in the jet-stirred combustor, substantial quantities of NOx were formed in gaseous premixed hydrocarbon-air combustion under stoichiometric and excess air firing conditions.

The NOx concentrations exceeded those based on the Zeldovich mechanism in many cases by more than an order of magnitude, indicating that coupling occurs between NOx formation and combustion kinetics. With carbon monoxide as the fuel, containing trace amounts of hydrogen, NOx emissions from the jet-stirred combustor were very similar to those obtained with methane fuel, at equivalent mixture ratios and slightly higher temperatures. With hydrogen as the fuel, NOx emissions were reduced to much lower levels at all mixture ratios compared with methane at the same temperatures. Under fuel rich conditions, the amount of NOx decreased precipitously in the jet-stirred combustor. All of the bond-type additives, i.e., nitric oxide, nitrogen dioxide, ammonia, cyanogen, and methyl amine, resulted in nearly equivalent NOx formation, operating the combustor with excess air. The conversion between additive input and NOx output was constant as the additive level increased to 3000 ppm equivalent NOx. The fraction of N-bond additives oxidized to NOx sharply decreased on the fuel-rich side. The mathematical model was extended to allow calculations of NO formation under fuel-rich conditions. Particle combustion capability was incorporated, and mixing effects can be calculated with the macro-mixing option. (Author summary modified)

24908 **APTIC NO. 45621**

Cataneo, Robert, John R. Adam, and Richard G. Semonin

INTERACTIONS BETWEEN EQUAL-SIZED DROPLETS DUE TO THE WAKE EFFECT. *J. Atmospheric Sci., 28(3):416-418, April 1971. 6 refs.*

In the development of raindrops from cloud droplets in warm rain, the collision-coalescence process is considered to be the main growth mechanism for droplets of unequal size greater than 20 micron in diameter. However, due to the wake effect, the possibility of equal-sized droplets colliding does exist for some maximum vertical separation of the droplets. An empirical study was performed which led to the experimental determination of the maximum vertical separation required, as a function of droplet size, for equal-sized droplets to be influenced by the wake effect. (Author abstract)

24909 **APTIC NO. 45369**

Dvornikov, A. G.

INCREASED CONCENTRATIONS IN CERTAIN COAL FRACTIONS. *Coke Chem. (USSR) (English translation from Russian of: Koks i Khim., no. 9:6-7, Sept. 1971. 5 refs.*

The mercury contents of fractions of some Donbass coals were analyzed. The mercury content gradually increased from the coarsest to the finest size fraction, reaching a maximum for the below 0.1 mm fraction. The three finest fractions contained less fusinite and vitrinite and far more pyrite than coarse fractions. The relationship between fusinite and vitrinite contents and fraction density was almost linear. The mercury content of the carbonaceous clay shale increased in the low-density fractions. However, the heaviest fraction contained a high proportion of mercury in clay shale. The mercury content of coal fractions is related inversely to their vitrinite and fusinite contents and directly to their pyrite and clay shale contents. The mercury found in anthracites is associated with the pyrite present. The methods used to concentrate mercury in the light and heavy fractions of anthracite can be used to recover mercury from coals in the course of normal cleaning.

24910 **APTIC NO. 45636**

Jacobs, W. R. and J. R. Williams

MEASUREMENT OF THERMAL RADIATION SCATTERING CHARACTERISTICS OF SUBMICRON REFRACTORY PARTICLES. *Georgia Inst. of Tech., Atlanta, Symp. Uranium Plasmas: Res. Appl. Atlanta, Ga., 1971, p. 137-143. 19 refs. (Nov. 15-17.)*

Measurements of the angular scattering characteristics of small particles dispersed in gases are needed for the analyses of gaseous core nuclear reactor concepts, for the evaluation of the climatologic effects of air pollution, and for evaluating other applications of small particles, such as reentry shielding and rocket nozzle cooling. The differential scattering parameter was measured for 0.04 micron tungsten particles in hydrogen and nitrogen at temperatures to 1088 K. It was also measured for 0.1 micron tungsten, three types of carbon particles, and fly ash in nitrogen at temperatures to 1000 K. By integrating the differential scattering parameter over 4pi steradians, the total scattering parameter may be evaluated. The 0.04 micron tungsten shows a temperature dependent total scattering parameter varying from around 4000 sq cm/g at room temperature to 7000 sq cm/g at 1088 K. The temperatures over which data were taken are not high enough to confirm the temperature dependence of the total scattering parameter of tungsten. The total scattering parameter for carbon was essentially independent of temperature and had a value of approximately 25,000 sq cm/g. Measurements fall within the limits predicted by Mie theory for particles in the 0.2-1.0 micron radius range. The actual particle agglomerates fall in this size range. (Author abstract modified)

24911 **APTIC NO. 45377**

Pepper, D. W. and S. C. Lee

THE EFFECT OF TURBULENCE INTENSITY ON DROPLET SUSPENSION IN AN ATMOSPHERIC WINDTUNNEL. *Preprint, Missouri Academy of Science, 15p., 1971. 10 refs. (Presented at the Missouri Academy of Science Conference, Springfield, Mo., April 1971.)*

The effects of turbulence intensity on the droplet suspension capabilities of a modified wind tunnel and flow characteristics around the droplet were investigated. Design and construction data for the vertical atmospheric wind tunnel are presented; detailed measurements of turbulence intensity were used to evaluate the relative effectiveness of the alternative design. Turbulence intensity, measured for a range of mean velocities from 1 cm/sec to 12 m/sec, increased rapidly as mean velocity decreased below 6 m/sec. For mean velocities within 6-12 m/sec, turbulence intensity remained constant at 0.5%.

24912 **APTIC NO. 45611**

Razumovskiy, S. D. and G. Ye. Zaikov

KINETICS AND MECHANISMS OF THE REACTION OF OZONE WITH AROMATIC HYDROCARBONS. *(Kinetika i mekhanizm reaktsii ozona s aromaticheskimi uglevodorodami). Text in Russian. Izv. Akad. Nauk SSSR Ser. Khim., no. 12:2657-2664, Dec. 1971. 16 refs.*

The kinetics and the mechanism of reactions of ozone with aromatic hydrocarbons were studied in laboratory experiments. A mixture of ozone and oxygen was bubbled through a bubbler filled with a solution of aromatic hydrocarbons, e.g., benzene, naphthalene, or anthracene, in carbon tetrachloride. Reaction constants and other kinetic reaction parameters were determined, and an empirical equation establishing the relationship between activation energy and bond energy was derived. Increased reaction constants with decreased bond energy of the aromatic system were observed. The reaction rates were much lower than those found for olefins. The reaction rates increased and the bond energies decreased in the order benzene, naphthalene, phenanthrene, pyrene, anthracene. The ozonides formed were similar in their chemical properties (colorless explosive powder with predominantly three-dimensional structure insoluble in standard solvents) to those of olefins. The inducing effect of preliminary reaction with ozone results preferably in the formation of bipolar ion at a carbon atom that is at the largest distance of the preliminary ozone attack. The mechanism of the reaction of ozone with unsubstituted aromatic hydrocarbons is assumed to be analogous with that of simple olefins, while alkyl-substituted aromatics such as ethyl benzene undergo reactions preferably accompanied by the formation of peroxy radicals and intense chemiluminescence.

24913 **APTIC NO. 45390**

Sutugin, A. G.

EFFECT ON NONLAGGING MOLECULAR FORCES ON THE COAGULATION AND CONDENSATION GROWTH OF PARTICLES OF HIGHLY DISPERSED AEROSOLS *(Vliyaniye nezapazdyvayushchikh molekuiyarnykh sil na koagulvatsionnyy i kondensatsionnyy rost chastits vysokodispersnykh aerozoley) Text in Russian. Dokl. Akad. Nauk SSSR, 201(3):647-650, 1971. 8 refs.*

The effect of nonlagging molecular forces on the coagulation and condensation growth of highly dispersed aerosol particles as a function of the size of the impinging particles was studied. The number of collisions between particles of i and j molecules is given by the equation Nij equals gamma K(ij) ni nj, gamma equals 1, if i is not equal to j, gamma equals 1/2, if i equals j, where ni and nj are the concentrations of the particles and Kij is the coagulation coefficient. The value of Kij is expressed by using the kinetic theory of gases. Equations for finding the critical ratio of the distance at which collision occurs between two interacting particles to the sum of the radii are given. Results were on the average 2% less than the value calculated without considering the distribution of the relative rates. Molecular forces show less effect on coagulation of particles of different sizes than of identical sizes. The dependence of the corrected Kij/Ko on y is given, where y equals mu 1/mu 2 and mu 1 and Mu 2 are the partical radii. Molecular forces accelerated the condensation growth of particles. The condensation of molecules of 2A radius (r) on particles of 50A radius (R) is considered. The energy of interaction depends not only on the relation r/R but also on its absolute value.

EFFECTS-HUMAN HEALTH

1972

24914 **APTIC NO. 46196**

American Conference of Governmental Industrial Hygienists

THRESHOLD LIMIT VALUES OF AIRBORNE CONTAMINANTS ADOPTED BY ACGIH FOR 1971. *Med. Bull., 32(1):74-98, March 1972. 10 refs.*

Threshold limit values are presented for a large number of airborne contaminants. The values refer to time-weighted concentrations for a 7 or 8 hour workday and 40 hour workweek. The limits are based on the best available information from industrial experience, experimental human and animal studies, and when possible, from a combination of the three. A brief discussion of basic considerations involved in developing threshold limit values for mixtures, and methods for their development, are given. Listed substances followed by the designation Skin refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either by airborne, or more particularly by direct contact with the substance. This attention calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the threshold limit value is not invalidated. It is recognized that such physical factors as heat, ultraviolet and ionizing radiation, humidity, altitude, and the like may place added stress on the body so that the effects from exposure at a threshold limit may be altered. Carcinogenic compounds are listed. Dusts, hydrocarbons, halogen gases, ammonia, nitrogen oxides, sulfur dioxide, and other toxic substances are mentioned.

24915 **APTIC NO. 45752**

Boucot, Katherine R., William Weiss, Herbert Seidman, William J. Carnahan, and David A. Cooper

THE PHILADELPHIA PULMONARY NEOPLASM RESEARCH PROJECT. BASIC RISK FACTORS OF LUNG CANCER IN OLDER MEN. *Am. J. Epidemiol., 95(1):4-16, 1972. 20 refs.*

The risk factors of lung cancer in older men were investigated in studies of 121 lung cancer patients among 6136 men aged 45 and over in Philadelphia who volunteered for semi-annual chest x-rays and answered questionnaires about symptoms, smoking habits, and occupation over a 10-year period. Data on race, death rates, histological type, and pollution concentrations of sulfates and dust were also examined. The risk of developing lung cancer increased with increasing age; was higher in nonwhites than in whites, and bore a dose-response relationship to cigarette 0smoking. As crudely measured by dust fall and sulfur dioxide levels post facto, there was no evidence that the risk increased with increasing levels of air pollution. Exposure to asbestos was the greatest occupational hazard. (Author abstract modified)

24916 **APTIC NO. 46157**

Fairchild, Glen A., Judy Roan, and James McCarroll

ATMOSPHERIC POLLUTANTS AND THE PATHOGENESIS OF VIRAL RESPIRATORY INFECTION. SULFUR DIOXIDE AND INFLUENZA INFECTION IN MICE. *Arch. Environ. Health, 25(3):174-182, Sept. 1972. 26 refs.*

Influenza infected mice exposed continuously to 20 ppm of sulfur dioxide for seven days after virus exposure developed more pneumonia than virus control mice. Dose-response experiments suggested that the post virus SO2-induced increase in influenzal pneumonia began at about 7-10 ppm. The increase in pneumonia was not influenced by altering the virus dosage within a 5-100 mouse infectious dose range. A similar increase of 15-20% in influenzal pneumonia was observed when mice were exposed to 25 ppm of SO2 prior to initiation of virus infection. The SO2 exposure had no effect on the growth of influenza virus in the lungs of mice. The increase in the amount of pneumonia was associated with SO2 concentrations which induced low grade, inflammatory lesions in the lung. (Author abstract modified)

24917 **APTIC NO. 45706**

Flowers, Nancy C. and Leo G. Horan

THE ELECTRICAL SEQUELAE OF AEROSOL INHALATION. *Am. Heart J., 83(5):644-651, May 1972. 7 refs.*

A study was conducted to define and describe the effects of aerosol inhalation on the cardiac conduction system in dogs. Sixteen dogs weighing between 10 to 23 kg were used. Ten were ventilated with air alone. After base-line electrical and biochemical information was recorded, dogs inhaled volatilized substances from bags sprayed with antiseptic spray or hair spray. Some mixture with room air was allowed. One dog inhaled only fumes from airplane glue. In the case of six dogs, oxygen air flow was directed into the bag. Blood gas samples were obtained. Intracardiac electrograms and surface electrocardiograms were recorded until dogs died or were put to death. Of the 16 animals, one was allowed to inhale glue with toluene and acetone but no fluoroalkane gas, and developed a mild sinus tachycardia only. One animal died accidentally from ventricular fibrillation due to improper pacing. A third animal was deliberately hyperoxygenated, but did experience sinus slowing. In the remaining 13 animals, evidence of suppression of the rate of sinus node occurred within seconds to minutes of aerosol inhalation. The effects were sinus bradycardia, A-V dissociation with progressively lower escape rhythms, and ultimate electrical asystole or ventricular fibrillation. The sniffer of aerosols in high concentration cannot depend upon subjective sensations in order to cease inhalation in time, for in 1/2 of the animals the development of fatal rhythm disturbances could not be reversed, despite reinstitution of artificial respiration and oxygenation when sinus bradycardia first occurred.

24918 **APTIC NO. 46133**

Giddens, W. Ellis, Jr. and Glen A. Fairchild

EFFECTS OF SULFUR DIOXIDE ON THE NASAL MUCOSA OF MICE. *Arch. Environ. Health, 25(3):166-173, Sept. 1972. 22 refs.*

Mice from a defined-flora colony which were free of disease and conventional mice which had mild upper respiratory tract disease were exposed to 10 ppm of sulfur dioxide for periods up to 72 hrs. Histopathologic effects in the nasal cavity were compared with those in the lungs within each group. Differences in response to SO2 between the defined-flora colony and the conventional mice were also compared. The earliest lesions due to SO2 were observed in the nasomaxillary turbinates after 24 hr of exposure and consisted of edema, necrosis, and desquamation of the respiratory and olfactory epithelium. There was far more severe injury in the nasomaxillary turbinates than in the remainder of the respiratory tract. The conventional mice with mild upper respiratory tract infection had more severe lesions than the defined-flora colony mice. (Author abstract modified)

24919 **APTIC NO. 45879**

Goldberg, Harvey E., Dorothy Calafiore, Victor Hasselblad, Steven Bromberg, and William C. Nelson

AIR POLLUTION AND SCHOOL ABSENTEEISM IN THREE SOUTHEASTERN CITITES FROM OCTOBER 1969 TO MARCH 1970. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center and Environmental Protection Agency, Research Triangle Park N. C., Div. of Health Effects Research, 28p., June 23, 1972. 14 refs.*

School absence records seem to represent an easily accessible health indicator for relating environmental pollution to respiratory illness in children. School absence and aerometric data from three southeastern cities, Charlotte and Greensboro, N. C. and Birmingham, Ala., were collected concurrently over a 6-month period from October 1969 through March 1970. The data were divided into three 2-month periods for analysis coinciding with seasonal variation in respiratory illness and an influenza epidemic. School absenteeism was highly variable, and could not be related to the total suspended particulate concentration. A significant relationship existed between socioeconomic status and school absenteeism, with the higher socioeconomic region having the lowest incidence of school absence. No significant racial differences in absenteeism were found.

24920 **APTIC NO. 45657**

Heistad, Donald D. and Robert C. Wheeler

EFFECT OF CARBON MONOXIDE ON REFLEX VASOCONSTRICTION IN MAN. *J. Appl. Physiol., 32(1):7-11, Jan. 1972. 15 refs.*

The effects of inhalation of carbon monoxide on blood flow to the forearm and hand and on reflex vascular responsiveness were observed in healthy men. Carbon monoxide inhalation causes tissue hypoxia by reducing oxygen tension. This study was done to determine whether the hypoxia induced by carbon monoxide causes an inhibition of reflex vasoconstrictor responses or whether the presence of a normal arterial oxygen tension allows preservation of vascular responses. Blood flow to the forearm and hand were measured with plethysmographs, and arterial pressure was obtained by auscultation. Resting values and responses to lower body negative pressure and to application of ice to the forehead were compared at three levels of carboxyhemoglobin 4% (control), 19%, and 25%. There was no evidence of stimulation of the sympathoadrenal system by carbon monoxide: heart rate was unchanged and there was no vasoconstriction in the hand. Carbon monoxide caused dilatation of vessels of the forearm and reduced the vasoconstrictor responses to lower body negative pressure and to the application of ice to the forehead. It appears that the hypoxia induced by carbon monoxide causes an inhibition of reflex vasoconstrictor responses despite the presence of normal arterial oxygen tension. (Author abstract)

24921 **APTIC NO. 45431**

Honma, Katsunori

THE EFFECTS OF HEAVY METAL AEROSOL PARTICLE SIZES ON DEPOSIT IN LUNGS. *(Jukinzoku earozoru no hainai chinchaku ni okeru ryukei no koka). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 14(4):341, July 1972.*

The effects of particle size of heavy metal aerosols on deposition in lungs of male Sprague-Dawley rats were studied. Nine-month-old rats weighing 260-290 g were placed in an inhalation chamber, and lead and tellurium aerosols with specific gravities of 11.34 and 6.2, respectively, were dispersed from a stable fume generator. The atomic absorption spectrophotometric method was used to detect metals deposited in lungs. The results show that the relative rate of deposition decreases as particle size increases and that the rate of lead deposition is lower than that of tellurium-- approximately 30% lower for 1 micron particles and 60% lower for 3 micron particles.

24922 **APTIC NO. 46107**

Knelson, John H.

DISCUSSION OF THE CARBON MONOXIDE STANDARDS FOR THE FEDERAL GERMAN REPUBLIC, PROPOSED BY THE VDI-KOMMISSION REINHALTUNG DER LUFT. *Staub, Reinhaltung Luft, 32(4):191-192, April 1972. 11 refs.*

Carbon monoxide provides an index of exposure in the form of carboxyhemoglobin. The most pertinent parameter of measurement, therefore, is COHb rather than ambient CO. The two most pertinent questions are: What level of COHb results from a given exposure to CO; and what emission levels are necessary to achieve the required ambient level? Empirically derived prediction formulas must be restricted in use to short exposure times. Using a comparison of three empirically derived formulas and a theoretical computer model, the model allows computer simulation of CO exposure kinetics with the added ability to vary a large number of imput parameters. The model suggests that moderate increases in physical activity for a person exposed to 80 ppm for one hr can result in COHb levels as high as 4%. In view of the discrepancies now existing in the literature on the toxicology of CO, it may be prudent to include a reasonable margin of safety when establishing air quality standards.

24923 **APTIC NO. 45351**

Man in t Veld, A. J. and H. Zeedijk

THE EFFECT OF OZONE ON THE PHYSICAL WORKING CAPACITY OF ATHLETES. *(De invloed van ozon op de belastbaarheid van sportlieden) Text in Dutch. Tijdschr. Soc. Geneesk., vol. 50:441-445, 1972. 16 refs.*

Fourteen volunteers were given ozone for 20 minutes in concentrations of less than 0.3 ppm, while exercising on an ergometercycle with a load increasing from 0 to 300 Watts; this did not appear to affect the lung function or the heart function. There were indications, however, that a number of physical complaints of those taking part in the 1968 Olympic Games in Mexico City could have been due to the ozone content of the atmosphere. (Author summary modified)

24924 **APTIC NO. 45360**

Martin, D. and W. Jacobi

DIFFUSION DEPOSITION OF SMALL-SIZED PARTICLES IN THE BRONCHIAL TREE. *Health Phys., vol 23:23-29, July 1972. 16 refs.*

The diffusion deposition of small-sized particles in the bronchial tree was studied using a plastic model of the upper bronchial tree which corresponded to a dichotomous lung model. The deposition probabilities in the different bronchial regions for inspiration and expiration were measured as function of air-flow rate in the range 0.1-50 l/min. Radioautographs were prepared to study the fine structure of the deposition pattern. The measured deposition probability values can be approximated by the relation w equals k times v to the minus n power (n greater than zero) where m is the slope coefficient, v is air-flow rate, and k is a characteristic factor for each generation and nearly equal for inspiration and expiration; n amounts to 0.65 plus or minus 0.07 for all bronchial generations. Deposition due to turbulent diffusion plays an important role in the trachea and larger bronchi. With increasing depth in the bronchial tree, however, the measured w values approach the the theoretical values for diffusion in a laminar air stream. (Author abstract modified)

24925 **APTIC NO. 46158**

Martin, S. Wayne and Russell A. Willoughby

ORGANIC DUSTS, SULFUR DIOXIDE, AND THE RESPIRATORY TRACT OF SWINE. *Arch. Environ. Health, 25(3):158-165, Sept. 1972. 22 refs.*

Six piglets were continuously exposed to corn dust, corn dust plus sulfur dioxide, or corn starch plus SO2. There were no clinical or pathological changes in the piglets exposed to corn dust alone. When combined with SO2, both corn dust and corn starch produced lesions similar to those observed earlier with SO2 alone. Clinical changes included ocular and nasal irritation with increased salivation and central nervous system depression. Histologically, alterations in the epithelium of the turbinates and trachea included loss of cilia, disappearance of goblet cells, alteration of cell type, and metaplasia. There was a loss of cilia from epithelium of larger bronchi following exposure to corn starch and SO2. There were no changes in the respiratory area of the lung which were attributable to exposure to dust of SO2. (Author abstract)

24926 **APTIC NO. 45385**

Morgan, Jean M.

NORMAL LEAD AND CADMIUM CONTENT OF THE HUMAN KIDNEY. *Arch. Environ. Health, 24(5):364-368, May 1972. 36 refs.*

The adult population in the southeastern United States was studied in a series of postmortem examinations to establish normal concentrations of renal lead and cadmium for the area and to evaluate possible adverse effects of increased concentrations in segments of the population subjected to additional long-term exposure. The upper limit of normal for renal lead concentration was set at 75 micrograms/g of ash; 5000 micrograms/g of ash was the upper limit of normal for cadmium, but with the possibility that this value was still too high. There was no significant correlation between long-term exposure to cadmium or lead and hypertension. There was, however, an association between neoplasia and increased renal cadmium content, although the relationship was not necessarily one of cause and effect.

24927 **APTIC NO. 46373**

Mueller, D.

POSSIBILITIES OF OCCUPATIONAL DAMAGE OF THE MUCOUS TISSUE OF THE UPPER RESPIRATORY TRACT WITH SPECIAL REGARD OF MECHANICAL IRRITATION. *(Moeglichkeiten professioneller Schleimhautschaedigungen der oberen Luftwege unter besonderer Beruecksichtigung mechanischer Irritationen). Text in German. Z. Ges. Hyg. Ihre Grenzgebiete (Berlin), 18(8):561-566, 1972. 19 refs.*

The effects of occupational exposure of various kinds of dust on the upper respiratory tract of humans are discussed. Inorganic, non-toxic dusts such as aluminum, iron, glass wool, hard metal, lime, quartz, and cement have a mechanically irritative effect. Cotton, corn, wood, hemp, flower, and tobacco primarily have an allergic effect apart from true traumatization. Irreparable damage is caused by all quartz-containing mineral dusts, lime, talcum, cement, a few non-toxic dusts such as hemp, jute, wood and flower, and chromium and cadmium vapors which frequently lead to a chronical hypertrophic rhinitis. This chronic irritation is due to the composition of the dust and the sharp-edged shape of the particles impacting on the mucous tissue. Caustic substances damage the ciliary epithelium or influence the pH regulation. The mucous transport in the regio respiratoris is disturbed and a germ invasion to any cavities cannot be ruled out. Depending on the inhaled dust quantity, bacterial sinusitis of the maxillary cavities is very likely to occur primarily with cement and lime dust. Some wood dusts, primarily toxic dusts from exotic wood, cause emphysema from a concentration of 20 mg/cu cm inhaled air onward. They are less frequent, however, than chronic hyperplasia of the upper respiratory tract.

24928 **APTIC NO. 46270**

Nakashima, Yasukazu, Shigeko Kusumoto, Shinto Chin, Kazuya Okamoto, Masaji Hattori, Ryuhei Tateishi, Ryo Yoshida, Kozo Ito, Genshiro Ide, Hiroji Otsu, and Yoshimori Ashihara

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE. *(Chisso sankabutsu no seitai ni oyobosu eikyo. NO2 no dobutsu bakuro jikken). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 145-156. 28 refs.*

A review is given on studies of chronic effects on the histopathology of the lung of animals exposed to nitrogen dioxide and the combined effect of NO2 and carbon dioxide. Mice exposed to 0.7 to 0.8 ppm of NO2 for one month showed proliferation of the epithelium of the trachea mucous membrane, decollements of degenerated cells, mucigogue, and bronchitis. Mice exposed to a mixed gas containing 50 ppm of CO and 0.5 to 0.8 ppm of NO2 showed higher carboxyhelium in blood on the third day of exposure compared to that exposed to gas containing only CO at the same concentration. However, after 15 days of exposure, the difference could not be observed. The effect on the epithelium of the trachea mucous membrane was also larger for the group of mixed exposure.

24929 **APTIC NO. 45599**

Oyanguren, Herman, Hugo Donso, Luis Prieto, Sergio Vargas, and Sergio Paz

PREVALENCE OF CHRONIC BRONCHITIS IN URBAN AND RURAL AREAS OF SANTIAGO AND ITS RELATION WITH AIR POLLUTION INDEXES. *(Prevalencia de la bronquitis cronica en un area urbana y una rural de Santiago y su relacion con el grado de contaminacion atmosferica). Text in Spanish. Rev. Med. Chile (Santiago), 100(1):101-105, 1972. 17 refs.*

The detected prevalence of chronic bronchitis reached 21% in an urban population against only 15.4% in a rural population. However, this difference in prevalence was not significant from a statistical viewpoint. The air pollution indexes were 10 times higher in the former than in the latter area. Prevalence of chronic bronchitis was greater in smokers than in nonsmokers in both populations. However, the prevalence of chronic bronchitis among nonsmokers was sensibly equal in one or the other studied population. This lack of separation would result from interplay of several factors, possibly including some sort of selective migration of groups. (Author abstract modified)

24930 **APTIC NO. 46150**

Pariente, R., J. P. Berry, P. Galle, E. Cayrol, and G. Brouet

A STUDY OF PULMONARY DUST DEPOSITS USING THE ELECTRON MICROSCOPE IN CONJUNCTION WITH THE ELECTRON SOUND ANALYSER. *Thorax, 27(1):80-82, Jan. 1972. 4 refs.*

The structures of two groups of lung lesions were studied by electron microscopy. The first group comprised samples of lung scars taken from patients dying from non-pulmonary diseases, and the second group samples of lung taken from six patients suffering from idiopathic diffuse interstitial pulmonary fibrosis. In both groups, the electron analyzer revealed large amounts of silicon together with other mineral substances formed of different elements situated within elastic type fibers. The elements identified included silicon, aluminum, iron, and magnesium. In the alveoli, type 2 pneumocytes had replaced the normal predominant type 1 lining cells to a greater or lesser extent. There were numerous electron opaque fibers, thought to be modified elastic fibers showing non-periodic striation, in the interstitial tissue. These elastic-like fibers were osmiophilic

24931 **APTIC NO. 46371**

Roethig, W. and H.-J. Wehran

THE DETERMINATION OF IRON, ALUMINUM AND TITANIUM IN SILICOTIC AND SILICOTIC-TUBERCULOSE LUNGS. *(Zur Bestimmung von Eisen, Aluminium und Titan in Silikose- und Silikotuberkuloselungen). Text in German. Deut. Gesundheitsw., 27(33):1555-1559, 1972. 20 refs.*

With increasing silicosis, iron, aluminum, and titanium are also accumulated in the dust and retained by the lungs. The iron aluminum and titanium concentrations in lung dusts were determined. After ashing of the lung dust isolated with formamide, the silicon dioxide concentration was determined followed by the determination of iron, titanium, and aluminum according to Fitzek and Stegmann. Iron concentrations between 3.55 anu 56 mg% were measured in the lungs. The aluminum concentrations ranged between 25 and 447 mg% and those of titanium between 0.40 and 2.43 mg%. In the lymph nodes, concentrations of 5.35 to 233 mg% were measured for iron, of 12.50 to 572. mg% for aluminum, and of 1.22 to 12 mg% for titanium. Because of the large fluctuations of the individual values, no relationships to type and duration of exposure were discernible nor a difference between silicosis or silico-tuberculosis. The average aluminum, iron, and even titanium concentrations rose with increasing severity of the silicosis. The concentrations of the three metals in the hylus lymph were much higher than those found in the lungs. A relationship to the degree of silicosis is not given. Contrary to SiO2 and zinc, Al, Fe and Ti remain lower in their increasing rates than the average total quantity of dust concerned. This is a characteristic feature for inert dust fractions.

24932 **APTIC NO. 45683**

Sakabe, Hiroyuki, Kiyoyuki Kawai, Ayanori Sauda, Kimiko Oki, Katsunori Honma, and Heihachiro Arito

THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS (NO. 3). *(Tainetsusei kobunshi kagobutsu no kanetsu ni yoru seiseibutsu no dokusei ni tsuite) (sono 3). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 14(4):130-131, July 1972.*

The toxicity of emissions from heated teflon was investigated. In 10 minutes, 0.72 g of polyfluoroethylenepropylene (PFEP) heated at over 500 C vanished; mice exposed to the emissions all died in the same period of time. More than 150 ppm of hydrogen fluoride gas was detected. At 350 C, only 3% of the sample PFEP vanished; mice exposed to emissions showed light symptoms of poisoning, e.g., difficulty of breathing and decrease in body weights. Mice exposed to emissions from polytetrafluoroethylene heated at 400 C died in 48 hours. When a filter which reduced more than half of the fluorides in the emission was used, only slight decreases of body weights were noted.

24933 **APTIC NO. 46135**

Selikoff, Irving J., Cuyler Hammond, and Jacob Churg

CARCINOGENICITY OF AMOSITE ASBESTOS. *Arch. Environ. Health, 25(3):183-186, Sept. 1972. 15 refs.*

The mortality experience of a group of 230 men previously employed in an amosite asbestos factory was studied during the years 1960 through 1971. Total deaths were more than twice the number anticipated: 46.4 were expected, and 105 occurred. Some 14 deaths were due to asbestosis. Both lung cancer and mesothelioma were found in considerable excess. Two or three deaths from lung cancer were expected, and 25 occurred. There were five deaths from mesothelioma. Occupational exposure to amosite asbestos can be associated with serious cancer hazard; its continued industrial use requires rigorous control. (Author abstract modified)

24934 **APTIC NO. 46269**

Sotoyama, Toshio

MEDICAL OBSERVATIONS ON THE HEALTH EFFECTS OF AIR POLLUTANT CAUSED BY PHOTOCHEMICAL REACTION. A GENERAL DISCUSSION. *(Sosetsu, kokagaku hanno ni yoru taiki osen seibun no seitai eikyo no igakuteki kosatsu). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 111-122. 37 refs.*

The effects of air pollution on asthma patients, athletic performances of healthy individuals, and eye irritation have been observed. Investigations conducted in Los Angeles in 1971 revealed that during smog episodes, 3/4 of the residents had symptoms, of which 90% were eye irritation. Increased asthma, nose and throat irritation, allergy, headache, and chest pain also occurred. While sulfur dioxide is water soluble and usually has an effect on the upper respiratory tract, nitrogen dioxide irritates the bronchi and alveoli of the lung. Ozone causes edema, bronchiolitis fidrosa obliterans, and secondary responses in central nervous system. The effects of other oxidants are also mentioned.

24935 **APTIC NO. 45651**

Stewart, Richard D., Terrance N. Fisher, Michael J. Hosko, Jack E. Peterson, Edward D. Baretta, and Hugh C. Dodd

CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE. *Science, 176(4032):295-296, April 21, 1972. 6 refs.*

Experiments were conducted to determine the effect of dichloromethane vapor on humans. Several persons were exposed to dichloromethane vapor in a series of four experiments. The exposure to dichloromethane vapor in concentrations of 500 to 1000 ppm, for 1 to 2 hr promptly initiated the formation of carbon monoxide in all 11 subjects tested. Since there was no overt evidence of increased red blood cell destruction, it appears that the dichloromethane may be the source of the carbon monoxide. Exposure to dichloromethane vapor for 2 hr in concentrations simulating those encountered during home point stripping operations resulted in carboxyhemoglobin saturations in excess of those permitted in industry from exposure to carbon monoxide alone. Not only was the peak carboxyhemoglobin saturation exceeded (over 7.9%), but the biological half-life of carbon monoxide, which is approximately 5 hr in a sedentary individual, was greatly prolonged, (the increase of carboxyhemoglobin saturation continued to 14% after exposure, and was still slightly elevated after 21 hr), thus intensifying the carbon monoxide exposure. It is impossible to predict the carboxyhemoglobin saturation that might be reached as a result of repeated 8-hour exposures to the industrial threshold limit value (TLV) of 500 ppm for dichloromethane. Additional investigations into the effects of dichloromethane on human beings are necessary, so that the TLV for dichloromethane can be reassessed, and, if necessary, readjusted to provide an adequate margin of safety.

24936 **APTIC NO. 45729**

Toyama, Toshio

INDOOR AIR POLLUTION AND ITS EFFECTS ON HUMAN BODY. *(Shitsunai kuki osen to jintai ni ataeru eikyo). Text in Japanese. Kuki Chowa Eisei Kogaku (J. Japan Soc. Heating, Air-Conditioning, Sanitary Engrs.), 46(6):540-551, June 1972. 36 refs.*

Effects on the human body caused by excessive carbon dioxide, carbon monoxide, and suspended dust are discussed. The generally accepted control criteria for these pollutants in a number of countries are also introduced. From the hygienic point of view, CO is not a harmful gas but is an indicator for the room ventilation. Physiologically, it s an essential gas for the survival of humans. Normal air contains about 0.04% CO2, but when it increases, the greenhouse effect and the direct effects on the human body occur. The threshold limit value of CO2 is 5000 ppm (or 9000 mg/cu m) or 1000 ppm, according to different Japanese agencies. Effects on the human body caused by lack of oxygen are reported. The general mechanism of CO poisoning is given. The relationship between carboxyhemoglobin in the blood and CO concentration in the lung cells is shown in a diagram. Cigarette smoking has much to do with increase of COHb level. The threshold and maximum allowable concentrations of CO established by various countries are shown. Effects of suspended dust on the human body become aggravated when sulfur dioxide is present. The size of the dust particulate is another important factor.

24937 **APTIC NO. 46085**

Truhaut, Rene

DANGERS OF THE CHEMICAL AGE. *(Dangers de l ere chimique). Text in French. Chim Ind., Genie Chim., 105(3):239-249, Feb. 1972. 10 refs. (Presented at a Conference in the Centre de Perfectionnement Technique.)*

The necessity of understanding the dangers of the chemical age is emphasized; examples of toxic risks in different fields are provided; and the main principles of prevention of these dangers are discussed. Toxicity may take the form of acute, sub-acute, short-term, and long-term intoxication. Particular attention should be paid to exposure to poisons possessing cumulative properties. Various toxic substances such as lead, cadmium, mercury, and fluorides have different forms of absorption and excretion. Human and environmental factors likely to have a qualitative or quantitative effect on toxicity and on the conditions under which it reveals itself are considered. There are risks in using chemicals in medical treatment. The presence of pharmaceuticals in the home is not always safe, especially in the case of unusual response of certain organisms to medicines. Fatalities have occurred due to overdosage or erroneous labelling. Workers are more exposed to chemical agents both in industry and agriculture (pesticides). Another major risk is posed by deliberate or accidental addition of chemical agents to foodstuffs and water. The general population is exposed to air pollution in the form of carbon monoxide, hydrogen sulfide, nitrogen oxides, and hydrocarbons. Other risks are related to the use of chemicals in cosmetics and household products. These risks can be minimized by setting purity standards for chemicals, labeling the development of toxic pathology or poison-treatment centers, and the establishment of concerning admissible limits for pollution in working atmospheres or urban air.

24938 **APTIC NO. 46351**

Tsunetoshi, Yoshimitsu and Toyohiko Adachi

CLINICAL OBSERVATIONS OF PHOTOCHEMICAL SMOG INCIDENTS AT TAKASHI JR. HIGH SCHOOL AND OTHER PLACES. *(Takaishi chugakko-to ni okeru iwayuru kokagaku sumoggu jiken no tinshoteki chiken). Text in Japanese. Japan Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 157-169. 2 refs.*

Twelve school boys and girls suffering from symptoms caused by photochemical smog were hospitalized and investigated. Nine students complained of eye irritation, which disappeared in from 30 minutes to 5 hours; 11 students had cough which disappeared in from 30 minutes to 23 hours. Other symptoms such as headache, chest pain, throat pain, difficult breathing, dizziness, and fever were also observed. However, examinations of results of the peripheral blood test, chest x-ray, and liver function test revealed that all students were normal.

24939 **APTIC NO. 46006**

Vasil eva, E. V.

CHANGES IN THE ANTIGENIC COMPOSITION OF THE LUNGS IN EXPERIMENTAL BERYLLIOSIS. *Byul. Eksperim, Biol. i Med., 73(2):76-80, Feb. 1972. 13 refs. Translated from Russian. 10p.*

The effects of experimental berylliosis on the antigenic composition of the lungs were investigated in rats. With the aid of immunoelectrophoresis six new antigens were determined in the nucleoprotein fraction of the lungs of rats with experimental berylliosis. Active anaphylaxis tests and Zilber analysis revealed that a part of the additional antigen contained beryllium in the antigenic group, whereas in other antigens it was lacking. The nature of the new antigens, the levels of their specifics for berylliosis, and their role in the pathogenesis of the disease, however, were not yet examined.

24940 **APTIC NO. 46163**

Veater, T. T.

LEAD POLLUTION, MOTOR VEHICLES AND HEALTH. *Environ. Health, 80(7):215-226, july 1972*

The growth of road traffic and the problem of lead pollution is reviewed. Tetraethyl lead is added to gasoline to prevent premature detonation, usually called knocking. After combustion the lead is emitted as organic salts or oxides in aerosol form, generally in combination with halogen scavengers and other additives. Particle size of the exhausted lead is mentioned. Lead presents a two-fold problem: that of the suspended element and that of the deposited element. Both aspects are considered, in addition to health aspects of the inhalation and ingestion of lead. Threshold limits are indicated. The effect of wind on lead dispersion is discussed, and an experiment is described that was undertaken to investigate the extent, if any, of lead pollution from a motor vehicle source on fruit and vegetables sold by the road side. Implications of the results of this experiment are considered in the light of the 1960 and 1970 Food Hygiene Regulations. Aspects of control are indicated, and recommendations are made.

24941 **APTIC NO. 45404**

Vogel, James A. and Malcolm A. Gleser

EFFECT OF CARBON MONOXIDE ON OXYGEN TRANSPORT DURING EXERCISE. *J. Appl. Physiol., 32(2):234-239, Feb. 1972. 17 refs.*

Oxygen transport was studied in eight men at rest and during submaximal and maximal work while exposed to air and a 225-ppm carbon monoxide-air mixture. The latter resulted in a carboxyhemoglobin saturation of 18-20% with no change in arterial O2 tension. During CO inhalation, resting oxygen uptake was maintained with unchanged cardiac output and unchanged arteriovenous difference, although arterial and venous O2 contents were lower. During submaximal exercise, O2 delivery was maintained with a greater cardiac output but smaller arteriovenous O2 difference as compared to normoxic controls. During maximal work, cardiac output was no greater and mixed venous O2 content no less than in normoxia and, as a result, maximal O_2 uptake fell by 23%, i.e., proportional to the arterial desaturation. This indicates that the leftward shift of the oxyhemoglobin dissociation curve which accompanies CO exposure is compensated for by a lower venous O_2 tension so that O_2 transport capacity is not different from that seen in hypoxic hypoxia.

24942 **APTIC NO. 46134**

Waller, R. E.

THE COMBINED EFFECTS OF SMOKING AND OCCUPATIONAL OR URBAN FACTORS IN RELATION TO LUNG CANCER. *Ann. Occupational Hyg., vol. 15:67-71, April 1972. 19 refs.*

Some of the published work on lung cancer mortality is considered in relation to possible interactions between smoking and other factors. Although there is evidence to suggest that smoking enhances the lung cancer risk in certain occupational groups, studies on general populations show that the effect of smoking is large compared with that of urban factors and there is no indication of any interaction between smoking and air pollution. (Author abstract modified)

24943 **APTIC NO. 46271**

Yokoyama, Eiji

THE EFFECTS OF O_3 ON LUNG FUNCTION. *(O_3 no hai kino ni oyobosu eikyo). Text in Japanese. Japan. Society of Air Pollution, Proc. Japan Soc. Air Pollut., Meet. Air Pollut. Caused Photochem. Reaction, 1972, p. 123-143. 58 refs.*

A review is given on studies of the effects of ozone on the lung function of rabbits, guinea pigs, cats, and dogs. Dogs exposed to O_3 at 26 to 34 pphm and 78 to 80 pphm at a rate of 3.5 to 6.5 l/min showed 71.7% and 59.2% absorptive rates, respectively. There was 30 to 40% more in the deep respiratory tract than the case when sulfur dioxide was the inhaled gas. Guinea pigs exposed to 0.5 to 6.1 ppm ozone showed an increase of respiratory rates and decrease of tidal volumes. A rabbit was sacrificed after being exposed to O_3 at 1 ppm for three hours, and the lung was compared to the control group. The ratio of wet weight to dry weight of the right lung of the test rabbit was much higher than that of the control rabbit. Cats exposed to low concentrations of O_3 had increased the airway resistance.

24944 **APTIC NO. 46055**

Zaborowski, Leon M.

ONLY YOUR CHEMIST KNOWS FOR SURE: DETERMINATION OF MERCURY IN MAN. *Preprint, American Chemical Society, Washington, D. C., 10p., 1972. 14 refs. (Presented at the American Chemical Society, National Meeting 163rd, Boston, Mass., April 9-14, 1972.)*

Human hair was tested for mercury content in Wisconsin. Recommendations to prevent mercury poisoning of residents are presented. Because of the widespread nature of this highly toxic environmental pollutant and its long half-life in the human system (roughly 2 months), it is important to determine the level of mercury contamination in man. Testing residents of Wisconsin for mercury content in the body was done by testing human hair. Since hair does not interact chemically with the body once it grows out of the scalp, it constitutes a calendar of body chemistry. Since hair grows at the rate of approximately 1.25 cm/mo, a section of hair cut 7.5 cm from the scalp would indicate the mercury concentration in the body 6 months ago. The results of analyzing over 200 Wisconsin residents showed that the vast majority of the students fell in the normal range with the mode falling between 1 and 2 ppm. Some of the high results obtained indicated contamination of the Flambeau, Wisconsin, Chippewa, and Menominee Rivers and Lake Superior. Many of the hair samples high in mercury contant came from residents living close to one of these state waters. Some projects which would lend themselves to this method would include testing canned sea foods (for both human and animal consumption); sampling local waterways and industrial plant waste for analysis; and, of course, testing hair. If anyone has an unusually high level of mercury (over 20 ppm) the source of mercury should be determined. (Author conclusions modified)

1971

24945 **APTIC NO. 45587**

Gardner, Donald Eugene

ENVIRONMENTAL INFLUENCES ON LIVING ALVEOLAR MACROPHAGES. *Cincinnati Univ., Ohio, Dept. of Environmental Health, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1971, 191p. 181 refs.*

When alveolar macrophages were separated from the acellular portion of the lavage fluid and maintained at 37 C in physiological saline, they were very unstable. However, stability of the alveolar macrophages was markedly improved when they were maintained in lavage fluid from the lungs. It was hypothesized that a protective factor was present in the lung fluid. Studies of the physical and chemical properties of the protective factor indicated that its activity is stable at decreased temperatures, and after dialysis and lyophilization, but that it is adversely affected by heating to 56 C for 30 min. Surface tension measurements demonstrated that it is capable of producing low surface tension and could be fractionated using techniques similar to those in studies of lung surfactants. The exposure of rabbits to ozone had an adverse effect on alveolar macrophages, and a dose-response relationship was established over the range of concentrations from 0.1-10.0 ppm for 2.5 hrs. When normal alveolar macrophages were maintained in lavage fluid which had previously been exposed to ozone in vitro, a marked loss of cell stability was also observed. The deleterious effects of ozone on lung cells may be due to an indirect action mediated by the presence of a protective factor in lung fluid. The O_3 reacts with lung fluid producing reactive products, probably free radicals and peroxides. These may be partially neutralized by water soluble scavengers in the fluid; may neutralize or inhibit the protective factor; may interact with the now unprotected membrane to cause lysis of the macrophage; and may result in an unprotected membrane of the alveolar macrophage which may now be susceptible to other factors causing lysis. (Author abstract modified)

24946 **APTIC NO. 45362**

Glick, M., K. G. Outhred, and H. I. McKenzie

THE ANALYSIS OF RESPIRATORY INCAPACITY IN COAL MINE WORKERS OF NEW SOUTH WALES. *Med. J. Australia (Sydney), vol. 2:1136-1140, Nov. 27, 1971. 6 refs. (Presented at the Australian Society of Occupational Medicine, Annual Meeting, Canberra, Australia, Oct. 2-4, 1970.)*

Methods to simplify the diagnosis of respiratory incapacity in coal mine workers are examined. Based on examinations of post-mortem lung specimens of cases from New South Wales miners, clinical, radiological, fluoroscopic, and electrocardiographic guidelines were developed for the assessment of respiratory diseases. The most common respiratory ills in coal miners include pneumoconiosis, emphysema, and chronic bronchitis; chronic obstructive lung diseases, e.g., asthma, sarcoidosis, and neoplasms, are rarer possibilities. Guidelines for ante-mortem diagnosis and principles used to determine attribution are outlined.

24947 **APTIC NO. 45370**

Porwik, Franciszek, Wieslawa Bielecka, and Ewa Kucharska

EFFECT OF CADMIUM, LEAD AND ZINC ON THE SURFACE TENSION OF THE MEMBRANE LINING PULMONARY ALVEOLI AND ON PULMONARY

SUSCEPTIBILITY CURVE. (Wplyw ladmu, olowiu i cynku no napiecie powierzchniowe wysciolki pecherzykow plucnych i na krzywa podatnosci pluc). Text in Polish. Med. Pracy (Warsaw), 22(1):11-19, 1971. 11 refs.

Eleven female Wistar rats, 3-4 months old and weighing 140-170 g, were exposed for 7 months to steel-plant air contaminated by dust containing cadmium, lead, and zinc compounds. The amounts of cadmium, lead, and zinc in each lung were calculated. The membrane lining pulmonary alveoli (0.01-0.05 g) was digested in a mixture of 2 ml redistilled water and 2 ml 6-N hydrochloric acid. In the final stage, a spectrograph was used to calculate tension at 525 nm. The pulmonary susceptibility coefficient in the experimental group was 0.82 plus or minus 0.06 cu cm/kg water vs. 1.12 plus or minus 0.04 cu cm/kg water in the control group. Residual volume in the exposed animals was 11.5 plus or minus 1.7 cu cm/kg vs. 7.58 plus or minus 0.61 cu cm/kg in controls. Total lung capacity was 18.80 plus or minus 8.14 cu cm/kg vs. 24.35 plus or minus 1.7 cu cm/kg. Surface tension of pulmonary alveoli rinsings was 33.12 plus or minus 1.58 dyn/cm vs. 27.03 plus or minus 0.39 dyn/cm. Average body weight and average lung weight of the experimental animals were 0.203 kg and 2.2 g, respectively. In controls, the respective values were 0.220 kg and 1.7 g. These results indicate considerable increase of surface tension of the membrane lining pulmonary alveoli due to the effect of cadmium, lead, and zinc. The coefficient of pulmonary susceptibility was markedly lowered in the test animals, leading to increased elasticity. The changes were chiefly caused by the cadmium compounds.

24948 **APTIC NO. 45612**

Rhodes, Mitchell L.

THE EFFECT OF CARBON MONOXIDE ON MITOCHONDRIAL RESPIRATORY ENZYMES IN LUNG TISSUE. *Preprint, American Thoracic Society, New York, 3p., 1971. (Presented at the American Thoracic Society, Annual Meeting, Los Angeles, Calif., May 16-19, 1971.)*

A new technique utilizing diaminobenzedene (DAB) to mark cytochrome oxidase (cytox) electron microscopically, was used to investigate the effect of carbon monoxide on lung tissue in mice. Lung tissue slices incubated in Warburg volumetric vessels, supplied with mixtures of CO, oxygen, and air or just oxygen and air were examined. The lung slices exposed to CO indicated complete and immediate inhibition of oxygen consumption. This was reversible; when the CO was washed out, oxygen consumption returned at a more rapid rate taken in the control situation. Cytochrome oxidase activity was inhibited in the presence of CO as evidenced by the lack of staining in mitochondria of slices exposed to CO, compared with those incubated in air and oxygen without CO. Compared with controls, the CO-exposed slices showed more tissue swelling and disruption and bizarre configurational changes in their mitochondria. An increase in cytoplasmic blebbing of the nonciliated bronchiolar cells, Clara cells, was prominent. This has been noted on exposure to irritant gases such as ammonia also. The fact that CO can inhibit cytox in mammalian cells and disrupt the oxidative metabolic chain leads to its interference with all cellular activities. This direct cellular inhibition coupled with the reduced oxygen content and decreased oxygen release in the intact animal is expected to cause most dysfunction in tissues with the most constant oxygen needs, such as the heart and brain. Whether these effects of 0.25% to 1% CO exposure in lung slices are identical to those occurring in the intact animal is uncertain but deserves further investigation. The metabolic consequences of high or prolonged exposure may be extensive. (Author conclusions modified)

24949 **APTIC NO. 45647**

Tucker, Anthony

CLEAN CUP--MOVE DOWN½ THE TOXIC COCKTAIL. *Your Environ., 2(4):162-164, 173-179, Winter 1971. 10 refs.*

Heavy metal contamination poses serious threats to human health and the environment. An an example, Swedish lakes that were contaminated with mercury 25 years ago are still a danger to fish and will remain so for many years, perhaps centuries. Contamination of the Irish Sea by metals resulted in the death of an estimated 50,000-100,000 birds in 1969. Virtually all birds examined had an unexpectedly high liver or kidney content of one metal; some had several metals in large amounts. Cadmium, mercury, selenium, lead, arsenic, and zinc were all found, sometimes at levels which even individually approached the toxic threshold. For humans, the contamination of the urban environment by lead is probably the most serious existing threat to health. Children tend to store lead in bone and measurement of blood lead level bears no relation to accumulated metal. In extreme cases, the stored metal is mobilized and lead encephalitis results. Even when encephalitis does not occur, mild lead poisoning can produce delayed effects on the development of the central nervous system. While paint cannot contain more than 0.5% lead, new World Health Organization standards allow 0.1 ppm lead in drinking water. However, water is only one source of contaminants. Food grown in metal-rich areas could be no less important, and air contamination, largely because metals are easily absorbed through the lungs, is probably most important of all. City air may contain up to 3.0% mercury.

EFFECTS-PLANTS AND LIVESTOCK

1972

24950 **APTIC NO. 45388**

Tokyo Metropolitan Environmental Protection Research Inst. (Japan)

PROGRESS REPORT ON TOKYO PHOTOCHEMICAL SMOG: DATA III (DAMAGES ON PLANTS). *(Tokyo kokagaku sumoggu chukan hokoku, shiryohen III (Shokubutsu higai jittai chosa kekka)). Text in Japanese. 93p., March 1972.*

Complete data from a special investigation conducted during 1971 on damages of photochemical smogs on plants are presented in tables. The data include monthly meteorological findings, pollutant measurements (oxidants, sulfur dioxide, and nitrogen dioxide), times of high concentration, more than 0.1 ppm oxidant concentration frequency, monthly averages of suspended particulates, oxidants, and sulfur dioxide. Plant damage was investigated at 15 parks in Tokyo, and indexes for appearances, growth rates, peripheral damages, leaf density, leaf formations, leaf colors, necrosis, shedding, and autumn coloring are presented for various plants in each park. Sulfur content in zelkova trees at 13 parks were analyzed by the sulfur combustion method. Indexes ranged from 92 to 400, the highest being at the Hibiya Park in central Tokyo. Vegetables in 10 residential wards were sampled at 86 points, and topography, sunlight, ventilation, water content in the soil, physical properties of the soil, fertilizer administration, and insects were checked. Some cases of necrosis, discoloration, mottling, and tip burn were found in vegetables such as scallions, spinach, turnips, and radishes. Other vegetables showed little effects.

24951 **APTIC NO. 46072**

Baumhardt, G. R. and L. F. Welch

LEAD UPTAKE AND CORN GROWTH WITH SOIL-APPLIED LEAD. *J. Environ. Quality, 1(1):91-94, 1972. 14 refs.*

The effect of soil-applied lead on plant response, grain yield, and lead content of plants was examined in experiments with corn grown in a field where lead acetate was applied to the soil at 8 rates within 0-3200 kg/ha. Emergence, plant height, and grain yield were not affected by the added lead; neither were any morphological, color, maturity, or other growth differences visually observed. Added lead increased the lead content of stover; for the 0 and 3200 kg/ha treatment, respectively, lead values were 2.4 and 37.8 ppm for young whole plants, 3.6 and 27.6 ppm for leaves at tasselling, and 4.2 and 20.4 ppm for whole plants at grain harvest. Grain lead content averaged 0.4 ppm and was not affected by added lead. (Author abstract modified)

24952 **APTIC NO. 46087**

Beard, J. H., B. C. Fletcher, and E. C. H. van Beresteyn

THE ENHANCEMENT OF ORANGE OIL OXIDATION BY SULPHUR DIOXIDE. *J. Sci. Food Agr., vol. 23:207-213, Feb. 1972. 17 refs.*

Reactions at 35 C of orange oil in contact with air and water were investigated by gas-liquid chromatography and by oxygen absorption measurements. The chromatography experiments were performed at a column oven temperature of 100 C. Nitrogen was used as the carrier gas with a flow rate of 0.50 ml/sec. A flame ionization detector was utilized. Oxygen uptake was measured in Warburg manometers containing Braun s solution as the barometric fluid and thermostatted at 35 + or 0.02 C. All reaction mixtures consisted of 2 ml of aqueous solution (citric acid concentration 2% w/v) and 0.25 ml of orange oil or monoterpene. Pressure changes were measured at constant volume, and an allowance was made for fluctuations in atmospheric pressure by use of control manometers containing distilled water. After storage at 35 C for 4 weeks, all reaction mixtures containing sulfur dioxide showed marked changes in appearance and odor. The extent of the changes increased with the SO2 concentration. The mixture containing citric acid and oil, and the mixtures containing oil, citric acid, and benzoic acid showed no obvious changes. The presence of citric acid reduced the extent of the oil-water reaction, and the further addition of benzoic acid had no obvious effect. The addition of SO2 to the oil-water-citric acid system drastically (almost linearly) increased the rate of oxygen absorption by the orange oil-SO2 mixtures. Both citric acid and an oxidant, such as butylated hydroxyanisole, slow the oxidation rate of orange oil-SO2 mixtures.

24953 **APTIC NO. 45616**

Chang, Chong W.

THE INFLUENCE OF OZONE ON GROWTH AND RIBOSOMAL RNA IN PINTO BEAN PLANTS. *Phytochemistry, 11(4):1347-1350, 1972. 16 refs.*

A study was made of the relationship between the level of ribosomal RNA and the rate of growth in pinto bean plants treated with 0.35 ppm ozone for 20 to 40 min. Cytoplasmic ribosomes and a fraction containing both cytoplasmic and chloroplast ribosomes were initially isolated from primary leaves. The rRNA components of 25S, 23S, and 16S were extracted from these fractions and analyzed by sucrose density gradient. The levels of cytoplasmic rRNA components, 25S and 16S, are not significantly affected by ozone. The peaks corresponding to 25S and 16S rRNA are relatively sharp and distinctive. This means that ozone does not degrade the two components of cytoplasmic rRNA. The rRNA contaminants from chloroplast ribosomes, if any, are assumed to be low, since there is no detectable 23S rRNA peak. Ozone specifically decreases the relative level of 23S of the chloroplast rRNA, as the rate of growth is inhibited, due to the direct action of ozone on the protein components of chloroplast ribosomes. The different responses of the two classes of rRNA to ozone are likely to be due to the different amino-acid residues of the two classes of ribosomal proteins and/or their different geometric configurations.

24954 **APTIC NO. 46073**

Cox, W. J. and D. W. Rains

EFFECT OF LIME ON LEAD UPTAKE BY FIVE PLANT SPECIES. *J. Environ. Quality, 1(2):167-169, 1972. 10 refs.*

The effect of species variation and lime treatments on lead uptake from lead-contaminated soils was examined. Lime in concentrations of 0, 2.2., and 4.4 t/ha was applied to two soils of Los Osos clay loam containing lead in the ranges of 76-112 ppm and 25-39 ppm; the lead uptake by 5 species of cereal grasses and herbs was also determined. The addition of lime did not affect the yield, but did reduce lead concentrations in the plant tops. At all times of harvest and lime rates, lead uptake values were greatest in Glycine max L., followed by Trifolium subterraneum and lesser but equal values for Zea mays L., Avena sativa L., and Triticum aestivum L. (Author abstract modified)

24955 **APTIC NO. 45540**

Heggestad, H. E., F. S. Santamour, Jr., and Leon Bernstein

PLANTS THAT WILL WITHSTAND POLLUTION AND REDUCE IT. *In: Landscape for Living. Washington, D. C., Government Printing Office, 1972. p. 16-22.*

GPO

Ozone, peroxyacetyl nitrate, sulfur dioxide, nitrogen dioxide, fluorides, and ethylene are pollutants that singularly or in combination can cause damage to plants in the form of lesions, tissue collapse, discoloration, defoliation, premature aging, and necrosis of leaf margins and tips. The concentration of these pollutants is high enough in some areas to result in economic losses. The sensitivity of the plants can be used to detect the presence of these pollutants and to augment monitoring instruments. Trees and other plants also play a role in removing gaseous pollutants and particulates from the atmosphere and in reducing noise. The ginko and the Ailanthus are two species which have been grown successfully in urban areas. Natural selection will result in more resistant plants, but the cultivation of particular species is desirable.

24956 **APTIC NO. 45776**

Heggestad, H. E.

HOW PLANTS FIGHT MAN-MADE POLLUTION. *Sci. Teach., 39(4), 4p., April 1972. 22 refs.*

Various investigations concerning the response of plants to polluted environments are reviewed. Removal of ozone by plants is regulated by the same factors that control the exchange of water vapor between the leaves and the atmosphere. Depending on the species, ozone concentration, and other factors, uptake of ozone by leaves often results in acute injury, premature aging, and plant senescence. Sulfur absorption by plants is least when the concentrations of sulfur dioxide are highest. Sulfur accumulation may occur even under pollution conditions which do not depress plant yield or the quality of plant products. The initial uptake rate of nitrogen dioxide by alfalfa and oats is directly proportional to concentration in the range of 0 to 24 pphm. Alfalfa removes gaseous pollutants in the following order: hydrogen fluoride most rapidly, followed by sulfur dioxide, chlorine, nitrogen dioxide, ozone, peroxyacyl nitrate, and nitric oxide. The absorption rate of nitric oxide is very low, and it is not possible to detect any absorption of carbon monoxide. There is a close relationship between the uptake of these pollutants by plants and their solubility in water. The action of various woody plants on SO2 removal is described. Soil organisms, including fungi, yeast, and bacteria, also play an important role in air purification, especially for gases such as CO and ethylene, which are not absorbed by green plants. soil also acts as an effective sink for SO2 and NO2. Trees, shrubs, and tall grass make effective sound barriers and thus reduce noise pollution. Removal of particulates by plants has little, if any, effect on the vegetation itself, but plant removal of gaseous pollutants, such as ozone, PAN, sulfur dioxide, and chlorine, may cause injury to plants.

24957 **APTIC NO. 45712**

Holak, Walter, Benjamin Krinitz, and John C. Williams

SIMPLE, RAPID DIGESTION TECHNIQUE FOR THE DETERMINATION OF MERCURY IN FISH BY FLAMELESS ATOMIC ABSORPTION. *J. Assoc. Offic. Anal. Chemists, 55(4):741-742, July 1972. (Presented at the Association of Official Analytical Chemists, Annual Meeting, 85th, Washington, D. C., Oct. 11-14, 1971.)*

A simple and rapid digestion technique is described for the determination of mercury in fish by flameless atomic absorption. The sample is digested with nitric acid in a closed system in a commercially available vessel made of Teflon. Tuna and pike were the types of fish used as samples for the study. A 30-minute digestion at 150 C is sufficient to convert the mercury to an inorganic form so that it can then be reduced to the elemental state, aerated, and determined by atomic absorption. The proposed digestion avoids the use of potentially explosive reagents. Results of recovery studies and a comparison with the sulfuric-nitric-perchloric acid digestion technique show that the two methods are in good agreement. The proposed digestion has the advantage of reducing the digestion time from 3-4 hours to approximately 45 minutes.

24958 **APTIC NO. 45711**

Hoover, William L.

COLLABORATIVE STUDY OF A METHOD FOR DETERMINING LEAD IN PLANT AND ANIMAL PRODUCTS. *J. Assoc. Offic. Anal. Chemists, 55(4):737-740, July 1972. 3 refs. (Presented at the Association of Official Analytical Chemists, Annual Meeting, 85th, Washington, D. C., Oct. 11-14, 1971.)*

A method for the determination of lead in food products was studied. Four general types of food were used in the study: grain products; fruit juice; meat; and vegetables. Two specific foods of each type were selected for a total of 8 samples: flour and cornmeal; apple and prune juice; hamburger and calf liver; and turnips and carrots. The method involves coprecipitation of lead with strontium sulfate, conversion to carbonate, dissolution in nitric acid, and determination by atomic absorption spectrophotometry. Eight collaborating laboratories reported analytical results for 24 test samples. The systematic error was essentially the same as the random error at the 99% level. Acceptable coefficients of variation were observed. The method has been adopted as official first action. (Author abstract modified)

24959 **APTIC NO. 46338**

Houten, J. G. ten

SOURCE, DISPERSION AND EFFECT OF CHEMICAL AIR POLLUTANTS. *(Herkomst, verspreiding en effect van chemische luchtverontreinigingen). Text in Dutch. Inst. of Phytopathological Research, Wageningen (Netherlands), 16p., 1972. 32 refs. (Presented at the Aerobiology Symposium, Wageningen, Netherlands, Jan. 1972.)*

The effects of general and specific air pollutants on plants are reviewed. The air pollutants enter into plants through the stomata of the leaves and may cause serious metabolic disorders on a cellular level. Sulfur dioxide causes necrosis of intercostal tissues without affecting the nerves. It has no cumulative effect as it is metabolized into harmless sulfates. Lichens were highly sensitive for SO2. Examples of plant damage and action radii in different areas are given. Ethylene, originating from automotive exhaust, causes epinasty in stomata in a concentration of 0.1 ppm. Nitrogen dioxide in a concentration of 0.25 ppm damages tomato. The effects of ozone formed in photochemical reactions on Pinus ponderosa were detected at a distance of 100 km from the source. Hydrofluoric acid emissions from a aluminum plant caused total destruction of conifers and needle damage up to a distance of 32 km. Cement dust and other solid particles may serve as condensation nuclei for other air pollutants. Reduced virulence of phytopathogenic fungi due to SO2 was observed; 0.5-1 ppm ozone concentrations, maintained over a few hours had a similar effect on Fusarium oxysporum, Colletotrichumlagenarium, Verticillium albo-atrum and V. dahliae. The growth-stimulating effect of acetaldehyde on Sclerotium rolfsi was observed. An air pollution monitoring network of 250 sampling stations, designed to measure SO2 and NO2, nitric oxide, and ozone concentrations is under construction in the Netherlands.

24960 **APTIC NO. 46071**

John, Matt K. and C. Van Laerhoven

LEAD UPTAKE BY LETTUCE AND OATS AS AFFECTED BY LIME, NITROGEN, AND SOURCES OF LEAD. *J. Environ. Quality, 1(2):169-171, 1972. 17 refs.*

The effects of lime, nitrogen, and lead applications, whether alone or in varous combinations, on plant yield, lead content, pH of the soil, and elemental plant composition were investigated. Soil application of lead increased lead uptake by lettuce to a greater degree than by oats. Application of lime repressed the uptake of added lead by both plants, while application of low levels of nitrogen reduced lead uptake by lettuce and oat roots only. Application of lead chloride decreased the amount of sulfur and phosphorus in plants, but levels of other elements were not affected by lead treatment. (Author abstract modified)

24961 **APTIC NO. 46263**

Johnson, Stanley

BURNT IN THE NAME OF PROGRESS. *New Scientist, 55(809):344-345, Aug. 17, 1972.*

In 1970, Brazil began work on the Trans-Amazon Highway which will run some 31,000 miles from Recife on the Atlantic to the Peruvian border. The highway will penetrate right into the heart of the Amazon rain forest, opening up what at the moment remains one of the last unexploited areas of the globe. Destruction of the forest ecosystem by burning is discussed, including various roles of the forest as a climatic buffer and in the assimilation of carbon dioxide and the release of oxygen. Socio-economic factors behind Brazil s policy to penetrate the frontier zone are mentioned.

24962 **APTIC NO. 46368**

Mack, D. and H. Berg

DETERMINATION OF LEAD IN VEGETABLE AND FRUIT INCLUDING GRAPES BY ATOMIC ABSORPTION SPECTROPHOTOMETRY. *(Bestimmung von Blei in Gemuese und Obst, einschliesslich Weintrauben, durch Atomabsorptionsspektrophotometrie). Text in German. Deut. Lebensm. Rundsch. 68(8):262-263, 1972. 3 refs.*

An atomic absorption spectrophotometric method was used to determine lead in 100 fruit and vegetable samples which grew along a street. After wet incineration of the vegetation, lead was completely linked to ammonium pyrolidine dithiocarbamate and was determined in a methyl-ketone phase. Lead concentrations smaller than 0.05 and 2 mg/kg were measured. Lead in grapes taken from alongside roads of different classification was also measured. Lead concentrations slightly exceeded normal concentrations in a few cases of plants growing next to streets.

24963 **APTIC NO. 45865**

Reinert, Richard A., David T. Tingey, and Hershell B. Carter

OZONE INDUCED FOLIAR INJURY IN LETTUCE AND RADISH CULTIVARS. *Preprint, Agricultural Research Service, Raleigh, N. C., Plant Science Research Div.; Environmental Protection Agency, Research Triangle Park, N. C., Div. of Ecological Research; North Carolina State Univ., Raleigh, 15p., 1972. 21 refs.*

Eight lettuce and nine radish cultivars were placed in nine exposure chambers and exposed for 1.5 hours and 35 pphm ozone, respectively. Thirty-six plants from each cultivar were used to evaluate relative sensitivity visually. Foliar injury to plants generally appeared first as a chlorotic and necrotic upper surface flecks which became bifacial as injury increased. In other cases a chlorosis and/or cell clearing occurred. A form of interveinal bleaching developed, which suggests that chlorophyll had been destroyed. Lettuce and radish cultivars were ranked according to injury means. Dark Green Boston was the most ozone-sensitive lettuce cultivar followed by Grand Rapids Forcing. The least sensitive cultivars were Black-Seeded Simpson and Great Lakes. Cherry Belle was the most ozone-sensitive radish cultivar, and Icicle was the least sensitive cultivar. The radish cultivars could be divided into two groups with Cherry Belle, Crimson Giant, Comet, and Champion more sensitive to ozone than other cultivars.

24964 **APTIC NO. 45773**

Tingey, David T., Roger C. Fites, and Carlos Wickliff

FOLIAR SENSITIVITY OF SOYBEANS TO OZONE AS RELATED TO SEVERAL LEAF PARAMETERS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Div. of Ecological Research and North Carolina State Univ., Raleigh, Botany Dept., 21p., 1972. 21 refs.*

The development of the first trifoliate leaf of soybean was followed to determine the relationship between foliar sensitivity to ozone and leaf growth, stomatal resistance, and selected soluble metabolites. Soybean was grown in washed gravel and Jiffy mix (2:1 by volume) in 225 cu cm cups. The plants were grown in a controlled environment room having a 24-hour diurnal cycle consisting of 12-hour photoperiod at a light intensity of 36,000 luces and a dark period interrupted by 3 he of incandescent light at 5500 luces. Day temperature was 28 C and bight temperature was 21 C. Relative humidities were about 60 and 80% for day and night, respectively. Plants were watered twice daily. Four plants from each of the eight developmental stages were placed in an exposure chamber covered with clear Teflon located in the controlled environment room. They were then exposed in a dynamic system, for 2 hours to clean air contaminated with 980 micrograms/cu m (50 pphm) ozone. Two days later the amount of ozone-induced leaf injury was visually estimated in 5% increments (zero to 100% scale) as the percentage of the upper leaf surface showing chlorosis, necrosis, or both. Relative stomatal resistance was determined at each harvest, with a ventilated diffusion porometer. Relative stomatal resistance to gas exchange was low during the early stages of leaf growth, but increased rapidly about 25 days after seeding; because gas exchange decreased as the leaf aged. Foliar injury increased rapidly as the young leaf expanded, reaching a maximum between 11 and 16 days after seeding. Maximum injury occurred before complete leaf expansion and slowly declined with leaf age. Protein, free amino acids, sucrose, and starch concentrations, and nitrate reductase levels were highest during the early stages of leaf growth and then decreased as the leaf aged. Total soluble sugars, as measured by anthrone, declined as foliar injury intensified and then increased as foliar injury decreased. Reducing sugar levels increased with advancing leaf age. Trends in metabolite levels relative to increased foliar sensitivity to ozone were different from trends reported for other species. This indicates that metabolite pools do not play the primary role in governing ozone sensitivity.

24965 **APTIC NO. 46105**

Turunen, Johannes and Asko Visapaa

SULPHUR IN PINE NEEDLES AND BIRCH LEAVES. PART II. SULPHUR CONTENTS AROUND A PULP MILL. *Pap. Puu., no. 4:263-271, 1972. 11 refs.*

The conditions of the trees in the vicinity of a pulp mill in Finland and the content of sulfur and chlorine in the needles and leaves were investigated prior to the installation of a new recovery boiler. Needle and leaf samples were collected at distances of 0.5-5 km from the mill and in a town where there were no pulp mills. An analytical method based on x-ray fluorescence was used. The pine needles and birch leaves contained chlorine in no more than negligible amounts. The highest sulfur values in pine needles were less than one half the danger level (0.5%). Similar mean values were determined for the total sulfur contents in pine needles in the town and from a central area about 2 km NNE from the pulp mill.

24966 **APTIC NO. 46260**

Waggoner, Paul E.

ROLE OF PLANTS IN IMPROVING THE ENVIRONMENT. *J. Environ. Quality, 1(2):123-127, 1972. 16 refs. (Presented at the American Association for Advancement of Science, Chicago, Ill., Dec. 28-29, 1970.)*

Foliage, especially foliage that is well watered and rapidly taking in carbon dioxide, improves our environment in tangible ways as well as aesthetically. Properly arranged, foliage can shade us without stilling the breeze and thus balance our energy budgets comfortably. When the productivity of crops per acre is increased, this frees land for parks and wilderness. Plants can also heal scarred land and scavenge pollutants from waste. Foliage can take in air pollutants. The assimilation of ozone by foliage can significantly cleanse the air of pollutant ozone much as the photosynthesis of a crop can decrease the carbon dioxide concentration of the air. The resistance to ozone uptake is the same as the resistance to transpiration of water. A mathematical simulator for estimating whether foliar uptake is significant or merely interesting is illustrated. (Author abstract modified)

24967 **APTIC NO. 45557**

Wood, Francis A.

AIR POLLUTION RESEARCH NEEDS IN FORESTRY. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 20p., 1972. 10 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-152.)*

Research needs with respect to the effects of air pollution on forests are presented. The principal difference between research needs pertaining to forests in comparison with those pertaining to herbaceous plants is a function of the perennial nature of forests. Research areas that need attention in the future include: a determination of the impact of air pollution on forests, the effects of pollutant interactions, the effect of pollutant-biopathogen interactions, an examination of changes in the nature of air pollution problems associated with applications of control technology, the development of additional field diagnostic techniques, and the use of chemicals and resistant plant materials to minimize air pollution effects. The effects of specific air pollutants, such as sulfur dioxide, hydrogen fluoride, ozone, peroxyacetyl nitrate, and hydrogen chloride, at the cellular, whole plant, and plant community levels need to be elucidated. (Author abstract modified)

1971

24968 **APTIC NO. 45604**

Carison, Clinton E. and Jerald E. Dewey

ENVIRONMENTAL POLUTION BY FLUORIDES IN FLATHEAD NATIONAL FOREST AND GLACIER NATIONAL PARK. *Forest Service, Missoula, Mont., Forest Insect and Disease Branch, 62p., Oct. 1971. 27 refs.*

The major cause of vegetation injury and damage on forested lands near the Anaconda Aluminum Company was studied. Research took the form of studies of visual burn, chemical analysis, histological analyses, aerial photography of area, and entomological (insect) sampling. Fluorides generated by the Anaconda Aluminum Company were determined to be the primary cause of the injury and damage to vegetation in the surrounding area. Highest fluoride concentrations, up to 1000 ppm, in foliar tissue were found near the Anaconda aluminum plant. Data indicated the fluorides were carried by air movement from the aluminum plant through a saddle in Teakettle Mountain to Glacier National Park, following the pattern of the prevailing winds in the area. Elevated fluorides (greater than 10 ppm) were found in vegetation on Columbia Mountain and Teakettle Mountain, in vegetation near the towns of Columbia Falls, Hungry Horse, and Coram, Montana, and in the southwest portion of Glacier National Park. Varying degrees of visible fluoride injury were found on vegetation over more than 69,120 acres. Although fluoride emissions were reduced during the summer of 1970, fir and spruce trees continued to accumulate fluorides at the same rate as in 1969. Definite histological reactions to elevated fluorides occur in conifer needle tissue, including hypertrophy of parenchymatous cells. Fluorides also accumulated in insect tissue. All groups of insects studied contained high fluoride levels. Pollinators possessed the highest, up to 406 ppm. Cambium feeders contained in excess of 52 ppm, indicating that fluoride must be translocated in the cambium of trees. Predatory insects had fluoride counts over 53 ppm, showing fluoride is passed along the food chain. Insect population samples indicated that elevated fluoride levels in pine needles lead to a buildup of the pine needle scale. During the summer of 1971, evaluations of possible timber growth losses and pasture grazing lands the should not be utilized due to fluoride were evaluated. Environmental damage can be stopped only by installation of pollution abatement equipment to limit fluoride emission to 0 lb/day, which is impossible, or by closing the plant, which is also impossible. The only possibility left is installing a permanent system to monitor fluoride pollution. (Author conclusions modified)

24969 **APTIC NO. 45663**

Compton, O. C., F. W. Adams, Stanley Elliott, Jack H. Wood, D. W. Claypool, and R. K. Marsh

FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS. *Oregon Agricultural Experiment Station, Corvallis, Rept. 335, 30p., July 1971. 32 refs.*

The flourine level of plants in an area intended for construction of an aluminum plant was studied to supply reference data in anticipation of pollution after start of plant operation. Cultivated and native plants within 6 mi of the factory site were sampled. Pasture herbages contained an average of 0.8-3.2 ppm fluorine, with only 11% of the samples exceeding 3.4 ppm. The fluorine content of each of the other six species averaged 2.9 ppm, with the exception of spruce needles containing 4.2 ppm. Five improved strains of pasture grasses maintained in pure strands were consistently and uniformly low in fluorine content. Within the area, differences in terrain, river valley, or distance from projected factory site produced no trends in fluorine concentrations. (Author summary modified)

24970 **APTIC NO. 45615**

Heagle, Allen S. and Linda W. Key

EFFECT OF PUCCINIA GRAMINIS F. SP. TRITICI ON OZONE INJURY IN WHEAT. *Preprint, Agricultural Research Service, Raleigh, N. C., Plant Science Research Div. and Environmental Protection Agency, Research Triangle Park, N. C., Div. of Ecological Research, 17p., 1971 (?).*

Significantly less ozone injury occurred in mesophyll cells in the substomatal areas of wheat leaves inoculated with urediospores of wheat stem rust fungus than in uninoculated leaves. The protection was present in inoculated areas when exposures to ozone at 30 pphm began 2, 3, or 4 hr after urediospore incubation started, but not after 1 hr. These results indicate an early interaction between parasite and host. The mesophyll cells under stomata with appressoria attached were rarely injured. Mesophyll cells under stomata without appressoria attached were also protected in areas of the leaf that were inoculated. Unincoculated areas were not protected. These results suggest that a diffusible substance is produced by germinating spores and infection structures that results in protection of localized areas of wheat leaf tissue from ozone injury.

24971 **APTIC NO. 45558**

Hoeft, R. G. and L. M. Walsh

EFFECT OF CARRIER, RATE, AND TIME OF APPLICATION OF S ON THE YIELD, AND S AND N CONTENT OF ALFALFA. *Preprint, Wisconsin Univ., Madison, Dept. of Soils, 16p., 1971. 21 refs. (Also: Hoeft, Robert Gene, In: I. Identification and Correction of S Deficiency in Wisconsin. II. Atmospheric Contribution of S and N. Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1972.)*

Field experiments were conducted at nine locations in Wisconsin to evaluate the effect of carrier, rate, and time of application of sulfur on yield, S uptake, and S and nitrogen content of alfalfa. Significant response to S was obtained at five of the nine locations. In the first year after application, sulfate sulfur (SO4-S) carriers were more effective than prilled elemental-S, 88% S and 12% bentonite, in correcting S-deficiency of alfalfa. In the second year after application, the various S carriers were equally effective. The results of this study indicated that 28 and 56 kg S/ha as potassium sulfate (K2SO4) were adequate to correct S-deficiency for a one-year and two-year period after application, respectively. At least 56 kg S/ha as elemental-S was required to obtain a significant yield response and this occurred only in the second year after application. A spring application of K2SO4 was more effective than a fall application, and K2SO4 applied at a rate of 28 kg S/ha each year over a two-year period was more effective than as single application of 56 kg S/ha made at the beginning of the two-year period. No significant difference between spring and fall application of elemental-S was noted in the yield or S-uptake values. In the second year, a single application of elemental-S made at the beginning of the experiment was more effective than an equivalent rate applied on an annual basis. Significant yield response was observed when the concentration of S in the tissue was 0.22% S or less. (Author abstract modified)

24972 **APTIC NO. 45559**

Hoeft, R. G., D. R. Keeney, and L. M. Walsh

ATMOSPHERIC CONTRIBUTION OF S AND N IN WISCONSIN. *Preprint, Wisconsin Univ., Madison, Dept. of Soils, 75p., 1971. 23 refs. (Also: Hoeft, Robert Gene, In: I. Identification and Correction of S Deficiency in Wisconsin. II. Atmospheric Contribution of S and N. Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1972.)*

A monitoring program to determine the seasonal distribution of sulfur and nitrogen from the atmosphere, and a greenhouse experiment to evaluate the absorption of atmospheric sulfur dioxide by alfalfa were conducted. Atmospheric SO2 levels at all rural and urban locations were low in the summer months and increased markedly in the winter months and, on the average, the values in urban areas were about twice those in rural areas. The SO2 collected 2 km from an industrial location and was 10 to 15 times as high as the urban locations. At a distance of 5 km this value dropped to levels comparable to urban areas and to rural levels at 10 km. Sulfate in precipitation followed the same seasonal and location trends as did SO2 with 16, 42, and 168 kg of S/ha/year being deposited in rural, urban, and industrial locations, respectively. An overall state average of 30 kg S/ha/year was estimated. The amount of ammonium compounds and organic nitrogen deposited by precipitation was highest during the spring months and lowest during the winter months. Nitrate deposition was relatively constant for all locations and was slightly lower in the winter months. Total N additions ranged from 13 to 30 kg/ha/year, and an overall state average of about 20 kg/ha/year was estimated. (Author abstract modified)

24973 **APTIC NO. 45389**

Kozyukina, J. T. and V. I. Obraztsova

DYNAMICS OF TREE DAMAGE DUE TO COKE-CHEMICAL INDUSTRY GASES. *(Dinanika povrezhdayemosti drevesnykh rasteniy gazami koksokhimicheskogo proizvodstva). Text in Russian. Uch. Zap. Perm. Gos. Univ., no. 256:191-196, 1971. 11 refs.*

Weekly examination of decoloration, spotting, lifetime, and xenomorphism of leaves and tree growths (height and volume) were made during 1968-1969 on a series of 10 to 15-year-old trees exposed to atmospheres polluted with sulfur compounds, phenols, ammonia, and coal dust. Injury to trees was observed. Harmful changes were most pronounced in older trees, and decreased in poplar, ailanthus, mulberry, acacia, English elm, and were smallest in privet. A direct relation was observed between the extent of xenomorphism and plant resistance to polluting gases. (Author abstract)

24974 **APTIC NO. 45617**

Miller, Paul R.

OXIDANT-INDUCED COMMUNITY CHANGE IN A MIXED CONIFER FOREST. *Preprint, American Chemical Society, Washington, D. C., 38p., 1971. 30 refs. (Presented at the American Chemical Society, National Meeting, 161st, Los Agneles, Calif., March 28 - April 2, 1971.)*

The typical stand composition of a mixed conifer forest, degree of ponderosa pine injury, and mortality in relation to the concentrations of oxidant air pollution in a heavily damaged area were investigated. Ozone meters were used to collect oxidant air pollution data. The effects of chronic oxidant injury on seed production, survival of conifer species in the early growth stages, the establishment of seedlings, competitive abilities of conifers, the effects of oxidants on established conifers and on host-parasite relationships, and changes in the physical environment of an oxidant damaged stand were studied. The successional trends in the mixed conifer forest under chronic exposure to oxidants vary greatly with the site. As ponderosa pine continues to decline in numbers, the conditions favor natural regeneration of the less desirable shrub species more than the other conifers. White fir may have a competitive edge over the remaining conifers, but the degree of oxidant tolerance of white fir is still questionable. (Author summary modified)

24975 **APTIC NO. 45533**

Ryder, Edward J.

SELECTION AND BREEDING OF PLANTS FOR INCREASED RESISTANCE TO AIR POLLUTANTS. *Preprint, American Chemical Society, Washington, D. C., 1971. 35 refs. (Presented at the American Chemical Society, National Meeting, 161st, Los Angeles, Calif., March 28 - April 2, 1971.)*

A few crops, ornamental plants, and forest plants were investigated for variations in reaction to air pollution. Evidence for a genetic basis for resistance to pollutants was found in several specie. Plant breeding techniques and current breeding programs are listed. The effects of the following toxicants are reviewed: ozone, fluoride, oxidants, sulfur dioxide, nitrogen dioxide, and peroxyacetyl nitrate. Future needs and prospects are discussed. Breeding new varieties of plants, resistant to the toxicants, which can be sucessfully grown in a polluted atmosphere is considered.

24976 **APTIC NO. 45345**

William, A.

AIR, PRIMORDIAL FACTOR OF THE ENVIRONMENT. *(L air, facteur primordial de l environnement). Text in French. Ann. Gembloux, 77(2):111-120, 1971. 9 refs.*

A historical review is given of air pollution, and studies on plant damage due to air pollutants such as sulfur dioxide, hydrogen fluoride, hydrochloric acid, nitric acid, nitrous acid, ammonia, hydrogen sulfide, bromine, and mineral oils are summarized. The relative sensitivities of certain plants for air pollution are given. Atomic oxygen may react with nitrogen oxides and saturated hydrocarbons, forming peroxyacetyl nitrates and peroxypropyonyl nitrate. Sulfur dioxide present in air may be oxidized by ozone to sulfur trioxide to form finally sulfuric acid. Plant leaves develop whitish or brown spots within a few minutes on the action of ozone in concentrations of 0.1-0.2 ppm. Epiphyte plants and lichens are regarded by many scientists as the best pollution indicators. Territorial development plans for different regions of Belgium are reviewed with regard to air pollution prevention.

EFFECTS-MATERIALS

1972

24977 **APTIC NO. 45473**

Giles, C. H., C. D. Shah, D. P. Johari, and R. S. Sinclair

EFFECTS OF GASEOUS DIFFUSION IN THE SUBSTRATE ON LIGHT FASTNESS OF DYES. *J. Soc. Dyers Colour., 88(2):59-62, Feb. 1972. 16 refs.*

Various disperse dyes in cellulose triacetate (CTA) film and some dyes in Cellophane regenerated-cellulose film, sealed in envelopes of undyed hydrophobic films, namely polytetrafluoroethylene (PTFE), polyacrylonitrile (PAN), poly(ethylene terephthalate) (PET) and CTA, were exposed to light from a 400-W mercury lamp. Fading was retarded by the undyed films. The order of effectiveness was PTFE, PAN, PET, CTA, with PTFE as the most effective. The permeability of water vapor (except for PAN) or oxygen through these films decreased in the above order. The retardation was similar in magnitude to the corresponding differences in light fastness of the disperse dyes on textile fibers. It was suggested that the action, except possibly in PAN, was caused by retardation of the diffusion of an oxygen molecule towards contact with a dye molecule during the short life-time of the excited state of the dye; calculation showed that there was only a small chance of such contact. A mathematical expression was derived which showed that the rate of fading depends on both the life-time of the excited dye molecule and the rate of diffusion of oxygen in the substrate. The retardation effect operates to some extent in all fading of colorants in fibers or films. (Author abstract modified)

24978 **APTIC NO. 46131**

Luther, Ward L., Jr.

THE ECOLOGY OF AN AIR COMPRESSOR. *Compressed Air, 77(8):11-15, Aug 1972. 1 ref.*

With proper protection and care, an air compressor should last many years with minimum preventive maintenance, regardless of whether it is of the reciprocating, screw, centrifugal, or sliding-vane type. The first concern is dirt in the form of particulate matter. Location of the air inlet should be inspected as to its proximity to such sources of dirt as coal dust, ashes, stack gas, and oil fumes, and the direction of prevailing winds must be regarded. Knowing local inlet conditions and the size of the particulate matter, it is possible to select a suitable filter element, keeping in mind that the finer the filter the greater the first and operating costs of the filter. Location of the filter is considered, as well as suitable materials and coatings to protect the compressors from attack by chemicals. The compression of air generates heat, and all types of compressors must be cooled. Noise control is also considered.

24979 **APTIC NO. 46358**

Sautter, W. and F. E. Faller

TESTING ANODIZED ALUMINUM IN ACCELERATED AND NATURAL WEATHERING TESTS. *(Pruefung von anodisch oxidiertem Aluminium im Kurzzeitversuch und in der Witterung). Text in German. Werkstoffe Korrosion, 23(8):636-642, 1972. 15 refs.*

The weathering resistance of anodized aluminum is based on sufficient coating thickness and good sealing. The minimum coating thickness required depends on the corrosivity of the surrounding medium (gaseous contaminants, moisture, and particles such as soot, dust, or salt). The resistance under accelerated testing conditions can be projected to the effective behavior under natural conditions because the apparent conductivity under accelerated weathering is a good resistance criterion: the higher the apparent conductivity, the poorer the resistance in the atmosphere. Exceptions characterized by a combination of high apparent conductivity and high corrosion resistance can be explained in terms of the fast aging of the partially sealed oxide coatings. For this reason it is advisable in evaluating the corrosion behavior to take into account the aging behavior too. Colored anodic coatings are characterized by exceptionally good weathering resistance, even under marine conditions.

24980 **APTIC NO. 46112**

Shlyafirner, A. M., A. I. Golubev, and G. P. Yakubova

ATMOSPHERIC CORROSION OF LOW-ALLOYED STEELS. *(Atmosfernaya korroziya nizkolegirovannykh staley). Text in Russian. Zashch. Metall. (Moscow), 3(8):309-312, 1972. 6 refs.*

Rapid corrosion tests of low-alloy steels in a sulfur dioxide atmosphere are described. Considerable increase in the corrosion rate due to manganese additives was observed. Small amounts of chromium, nickel, copper, and silicon reduced the rate of corrosion. Nickel content exceeding 1% accounted for low initial rates of corrosion, but failed to retard the corrosion considerably. Chromium added in a smaller amount than nickel had a positive effect, and resulted in a reduced rate of corrosion as a function of time. The corrosion resistance of manganese and mild steels alloyed with nickel and chromium in the same proportions proved to be comparable. The comparative evaluation of the corrosion rates of similar low-alloy steels was possible by means of rapid test procedures.

EFFECTS-ECONOMIC

1972

24981 **APTIC NO. 46213**

Hittman Associates, Inc., Columoia, Md.

COST NOMOGRAPHS OF SELECTED SULFUR DIOXIDE ABATEMENT METHODS. *Office of Air Programs Contract EHSD-71-43, 142p., Jan. 1972. 43 refs.*

NTIS: PB 207108

To provide a basis for assessing the costs and effectiveness of alternative sulfur dioxide control systems, a study was conducted to provide a set of nomographs which would allow rapid and accurate assessment of these alternatives. Sulfur emissions can be controlled by stack gas control processes, desulfurization of oil or coal, or the burning of naturally-occurring low-sulfur fuels. The economic aspects involved are the capital and operating costs of stack gas and desulfurization facilities and the incremental costs of purchasing and shipping low-sulfur fuels. The main emphasis was placed on the system and economic analysis of the dry limestone process, the wet limestone process, the magnesium oxide process, catalytic oxidation, the TYCO chamber process, and the molten carbonate process. The most current technical and economic data were compiled and evaluated. The major cost parameters were identified and a method whereby the interrelation of these parameters could be depicted graphically was developed. The resulting nomographs allow the calculation of operating costs for any combination of plant size, fuel, sulfur content, load factor, fixed charge rate, and additive cost. Thus the optimum process can be selected for any given power plant. The economic feasibility of coal and oil desulfurization was also studied. The costs/ton of coal (barrel of oil) were determined, given a variety of conditions. Nomographs were developed for the determination of desulfurization costs, the comparison of these costs with those of the stack gas removal processes, and the determination of transportation costs; all fuel forms and modes of transportation were considered.

24982 **APTIC NO. 46323**

McGraw-Hill Publications Co., New York, Economics Dept.

FIFTH ANNUAL MCGRAW-HILL SURVEY POLLUTION CONTROL EXPENDITURES. *Preprint, 12p., May 12, 1972.*

Figures are given for 25 industries on how much must be spent for pollution control; present and planned investment for air and water pollution controls; present and planned total expenditures; total control expenditures as a percent of capital spending; and total research and development pollution control expenditures. The total estimated cost of bringing all existing U. S. business facilities up to present pollution control standards is $22.8 billion. Business plans to spend $4.91 billion for air and water pollution controls in 1972, a 51% increase above 1971. Preliminary plans for 1975 come to $5.38 billion. Air pollution control investment for 1972 will increase 59% above 1971 to $2.9 billion. In 1975 $3.0 billion will be spent on air pollution. Seven industries must invest over $1 billion to meet current standards; in decreasing order these are electric utilities, the petroleum industry, paper industry, iron and steel, nonferrous metals, chemicals, and commercial business. Total pollution control costs in 1972 will be 5.3% of all capital investment. In 1972, $904 million will be spent on research and development and in 1975 $1.31 billion will be spent.

24983 **APTIC NO. 46362**

INCREASING CONSUMPTION STABILIZES SITUATION IN ALUMINUM MELTING PLANTS. *(Steigender Verbrauch festigt die Lage der Aluminiumschmelzhuetten). Text in German. Metall (Berlin), 26(9):969-971, 1972.*

The Organization of European Aluminum Melting Plants (OEA) forecast an increase of aluminum consumption of more than 9% for 1972. Manufacturing costs also will rise by 10%. This cost rise is mainly due to measures for the protection of the environment. Dust, chlorine, and salt emissions must be limited. Many aluminum melting plants which have not yet been forced to control air pollution still hold illusionary ideas concerning the costs of such measures. The costs comprise costs for filters and buildings, low maintenance and power costs, secondary costs such as filter repairs, during which the furnace operation is halted. Primary and secondary costs amount to about 0.55 to 0.70 cents/lb.

24984 **APTIC NO. 45637**

Blaschke, Wieslaw

CALCULATION OF PROFITS AND PROFITABILITY OF POWER COAL CLEANING DEPENDING ON THE ACCEPTED ASH CONTENT IN THE CONCENTRATE. *(Obliczanie zysku i rentownosci wzbogacania wegla energetycznego w zaleznosci od przyjetej zawartosci popiolu w koncentracie). Text in Polish. Przegl. Gorn., 28(1):21-25, 1972. 18 refs.*

General formulae for the profitability of coal cleaning are discussed. The dependence of coal price on coal quality, and equation constants for specific coal types are calculated. Equations governing the dependence of the output of concentrate on ash content, and for calculating profit with different levels of ash content are given. An empirical model for evaluating existing and projected coal preparation facilities is discussed. Computer solution of the various equations is recommended. After initial data preparation by supplying values for variable ash content, profit and profitability curves can be obtained for the total range of ash content that can occur in the concentrate; the optimal ash content is most conveniently determined from these curves.

24985 **APTIC NO. 45833**

Huettner, David A.

NUCLEAR AND FOSSIL STEAM PLANTS: SOME SCALE, COST AND ENVIRONMENTAL CONSIDERATIONS. *Preprint, Inst. of Management Sciences, Providence, R. I., 51p., 1972. 25 refs. (Presented at the Institute of Management Sciences, International Meeting, Houston, Tex., April 4-8, 1972.)*

Cost comparisons between nuclear and fossil plants are complicated by several factors including: Atomic Energy Commission subsidies of nuclear power; change in Federal Power Commission accounting procedures regarding nuclear fuel inventory; costs of pollution control facilities; and the cost reduction to be achieved by nuclear plant scale-up efforts. Costs of light water nuclear plants and fossil generating plants are compared using available operating data rather than engineering estimates. This comparison indicates that, as of 1966-69, nuclear scale-up efforts had fallen short of the goal of total cost superiority over fossil steam plants. Possible explanations for the spread of nuclear power despite this apparent cost inferiority are presented. One of these explanations argues that, because of the Averch-Johnson effect, rate base considerations may induce utilities to select nuclear technology even in instances where the total unit costs are higher. This explanation may deserve further economic investigation. (Author introduction modified)

24986 **APTIC NO. 46063**

Rushton, James D.

POLLUTION CONTROL SPENDING: MANY MILLS WILL NEED TO MAKE DEALS. *Paper Process., 8(7):34-35, July 1972.*

The results of three surveys of pulp and paper industry expenditures for pollution control are presented. Estimates of the expenditures vary within anywhere between $80 and $180 million. One recent survey of capital expenditures gives a detailed breakdown of modernization/expansion and pollution control expenditures on a mill-by-mill basis 1971-1974. In many cases, expenditures for pollution control exceed those for production equipment. To lessen the financial burden of pollution control costs, a company may enter into agreement with another which may use its effluent as a raw material, finance treatment facilities jointly with other companies and/or a municipality, or transport liquid waste to a treatment plant operated by a municipality or another company, with payment for the treatment on a fee basis.

24987 **APTIC NO. 45890**

Wasp, T. H. and A. G. Sliger

DETAILED COST BREAKDOWN FOR SELECTED SULFUR OXIDE CONTROL PROCESSES (FINAL REPORT). *Kellogg (M. W.) Co., Houston, Tex., Research and Engineering Development, Office of Air Programs Contract CPA 70-68, Rept. APTD 1104, RED-72-1268, Task 7, 31p., March 17, 1972.*

NTIS: PB 209024

Detailed investment cost breakdowns are presented for the individual processing steps in the scrubbing areas of the magnesia base, wet limestone, citrate, and ammonia control processes for power plant stack gases. Individual processing components considered are scrubbers, scrubber circuit, flue gas reheat circuit, induced draft fans, and ductwork, valves, and expansion joints. The citrate process has the most expensive scrubber, a field-fabricated packed tower, while the Impinjet scrubber used in the ammonia scubbing process is the least expensive. The TCA absorbers used in magnesia base and wet limestone scrubbing are intermediate in cost. The reheat systems employed in the processes are based on total carbon steel construction, while alloy construction probably will be needed for the gas cooler, thus adding $3-4 million to the reheat system investments. Most likely, a different type of flue gas reheating system will be employed in any commercialization of the control processes. Control plants with two sets of scrubbers (venturis for fly ash removal and main scrubbers for sulfur oxide removal in magnesia and citrate processes) require about twice as much investment for ductwork as do those which utilize the main scrubber for both fly ash and sulfur oxide removal (wet limestone and ammonia).

1971

24988 **APTIC NO. 45531**

Ernst and Ernst, Washington, D. C.

A DESCRIPTIVE ANALYSIS OF THE BAKERY PRODUCTS INDUSTRY DETAILING INDUSTRY TRENDS AND CHARACTERISTICS RELEVANT TO ECONOMIC IMPACT ANALYSIS OF ENVIRONMENTAL STANDARDS. REPORT I. *23p., Oct. 29, 1971.*

A descriptive analysis is presented of the bakery industry, detailing industry characteristics and trends that are relevant to an economic impact analysis and a tentative evaluation of the overall impact of pollution abatement costs on the industry. The characteristics of demand and supply are presented, including the financial structure of the industry. Market structure and trends, processes, raw materials, types of firms, employees, and costs and prices are considered.

24989 **APTIC NO. 45561**

Ernst and Ernst, Washington, D. C.

A STUDY OF THE IMPACT OF POLLUTION STANDARDS AND CHARGES ON THE BAKERY INDUSTRY PART III REPORT II. *37p., Dec. 10, 1971.*

Because of the relatively low water discharge usage of the bakery industry and the low costs of abatement, the impact of pollution control costs is likely to be very insignificant. Total industry water discharge is approximately 4,000,000,000 gal/yr. Abatement costs in the most expensive year (1976) are estimated by the Environmental Protection Agency to be $4,840,000. It is estimated that industry sales will total approximately $9,000,000,000 in 1976. The costs of pollution abatement would thus raise costs $0.00054/$ of sales, given present price trends. Abatement costs would have to be 1000% higher in order to increase bakery prices 1%. (Author abstract)

24990 **APTIC NO. 45568**

Little (Arthur D.), Inc., Cambridge, Mass.

ECONOMIC IMPACT OF ANTICIPATED PAPER INDUSTRY POLLUTION ABATEMENT COSTS PART I EXECUTIVE SUMMARY. *Rept. C-78977, 19p., Nov. 1971.*

An assessment is presented of the economic impact on the paper and related industries that will result from the air and water pollution requirements anticipated through 1976. The basic approach used in the analysis was to subdivide the industry into its major product sectors, then assess which mills in each sector are marginally profitable in today's market. The assessment was based primarily on paper machine and mill size criteria, but also took into account the relative severity of pollution control problems in each sector, current overcapacity and price weakness, the degree of vertical integration of the facility, and current industry profitability levels. Future supply/demand trends in each sector were then evaluated to determine the likelihood that future price increases can be obtained to restore profits to an adequate level and to absorb additional pollution abatement costs. Estimated pollution costs were evaluated against current prices of pulp and paper products and expected profitability of marginal firms to assess the impact of these costs on price increases and mill shutdowns. (Author introduction modified)

24991 **APTIC NO. 45571**

Ernst and Ernst, Washington, D. C.

ANALYSIS OF ECONOMIC IMPACTS OF ENVIRONMENTAL STANDARDS ON THE BAKERY INDUSTRY. (PART I). EXECUTIVE SUMMARY. *5p., Dec. 1971.*

The consequences of pollution abatement requirements for the bakery industry were investigated. Pertinent industry structure and trends are presented, as well as the quantitative and qualitative findings concerning the economic impacts on the industry of abatement control expenditures.

STANDARDS AND CRITERIA

1972

24992 **APTIC NO. 45450**

Fri, Robert W.

ENVIRONMENTAL PROTECTION AGENCY. (40 CFR PART 60). STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES. EMISSIONS DURING STARTUP, SHUTDOWN AND MALFUNCTION. *Federal Register, 37(166):17214-17216, Aug. 25, 1972.*

On Dec. 23, 1971, pursuant to the Clean Air Amendment of 1970, the Environmental Protection Agency promulgated Standards of Performance of New Stationary Sources for fossil fuel-fired steam generators, incinerators, Portland cement plants, and nitric and sulfuric acid plants. A formal process is outlined by which sources whose emissions had exceeded the standards could seek to show why the excesses were excusable. Where a startup or shutdown which may lead to an excess emission is planned, the owner or operator of the source must notify both the EPA Administrator and the appropriate State or local air pollution control agency of the place, time, purpose, anticipated emissions, and other details of the planned operation at least 3 days in advance. Where an unplanned malfunction causing emission that may be in excess of standards occurs, notification of such details by telephone must be made within 12 hours after the start of the malfunction.

24993 **APTIC NO. 45438**

Hamanaka, Hironori

AIR QUALITY CRITERIA FOR NITROGEN OXIDES AND PHOTOCHEMICAL OXIDANTS. *(Chisso sankabutsu oyobi kokagaku okishi danto ni kansuru kankyo kijun ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 8(8):2-8, Aug. 1972.*

Japanese environmental standards for nitrogen oxides and photochemical oxidants are discussed. As proposed by a special committee, the average hourly concentration of nitrogen dioxide for 24 consecutive hrs must be below 0.02 ppm; that of photochemical oxidants must be below 0.06 ppm. For measurements of NOx, the Saltzman method has been widely used. However, the chemiluminescent method, which has shorter response time, is being developed. Photochemical oxidants include substances such as ozone and peroxyacetyl nitrate which oxidize potassium iodide and isolate iodine. This is utilized as the analytical method for the determination of oxidants. The effects of NO2 and photochemical oxidants on animal bodies at different concentrations are listed and described.

24994 **APTIC NO. 46081**

Kakunan, Taira

THE RECENT SITUATION OF REGULATIONS ON AIR POLLUTION. *(Kogai kisei no doko, Taiki kankei). Text in Japanese. Sekiyu Gakkai-Shi (J. Japan Petroleum Inst., Tokyo), 15(7):601-605, July 1972.*

The environmental criteria for sulfur oxides, carbon monoxide, and suspended particles 10 micron in grain size are discussed. One-hour averages for successive 24 hours should be 0.10 mg or lower per 1 cu m of the atmosphere; 1-hour values should be 0.20 mg per 1 cu m of the atmosphere. Lead, nitrogen oxide, hydrocarbon, and fluoride criteria are being set up. Sulfur oxides emission criteria were set up on Jan. 5, 1972. The new SOx criteria, are different by district such as 9.34 (K value) for Sapporo and Kokkaido, while they are 7.01 and 6.42 for Tokyo. Except for five over-congested areas, the criteria will have been met by some time in 1973. A nationwide survey of environmental and emission concentrations of SOx is planned for some time in 1973 to re-appraise effectiveness of the criteria and revise them if necessary. Regulations on fuel are presently enforced only in big cities, but the enforcement will cover more areas in the coming year. Not only the automotive emissions, but also other general sources of NOx emission should be considered in establishing the criteria. Studies are already underway. Dust emission criteria have been drastically strengthened effective June 1972.

24995 **APTIC NO. 46108**

Knelson, John H.

UNITED STATES AIR QUALITY CRITERIA AND AMBIENT STANDARDS FOR CARBON MONOXIDE. *Staub, Reinhaltung Luft, 32(4):183-185, April 1972. 31 refs.*

Data to place air quality standards on an irrefutable and unassailable scientific basis are not yet available. There is a public desire for a best judgment decision. Three studies on neurological function have shown a response to carbon monoxide proportional to the CO concentration that extends back to zero. Zero disturbance occurs at zero concentration. Carbon monoxide interferes with oxygen transport by displacement of oxygen from the hemoglobin molecule, changing the position and shape of the oxyhemoglobin dissociation curve, and enhancing existing ventilation imbalance effects. The heart and brain are the most susceptible to CO. It is suspected that when the body of available data on the physiologic effects of CO in humans is examined in its entirety, an 8 hr average of 9 ppm and a one hr average 35 ppm will be adopted even though there is no threshold below which no adverse effects occur. (Author conclusions modified)

24996 **APTIC NO. 46224**

Long, Ronald

STUDIES ON POLYCYCLIC AROMATIC HYDROCARBONS IN FLAMES. *Birmingham Univ. (England), Dept. of Chemical Engineering, National Air Pollution Control Administration Research Grant 5R01-AP-00323, 190p., March 1972. 277 refs.*

Polycyclic aromatic hydrocarbons in flames were studied with respect to analytical methods for their determination in soots and particulates, particularly gas chromatography and mass spectrometry; the formation and mechanisms of these compounds in pre-mixed and diffusion flames of simple hydrocarbons; and the reduction of the formation of polycyclic aromatic hydrocarbons using organometallic additives. An analytical method involving extraction of particulate matter followed by column chromatography and then programmed-temperature gas chromatography was simplified and made more rapid. The improved procedure was used to determine polycyclic aromatic hydrocarbon contents of soot samples. The use of an integrated ionocurrent technique in high resolution mass spectrometry was also examined. Samples were withdrawn from rich oxy-acetylene and oxy-acetylene low pressure flat flames using quartz microprobes and were analyzed by the two techniques. There was a marked similarity in the flames; the concentration profiles of diacetylene and other polyacetylenes, phenyl acetylene, styrene, and other polycyclic aromatics were determined. The mode of formation was examined. Research on the use of organometallics to control formation is reviewed. (Author abstract modified)

24997 **APTIC NO. 46064**

Naccache, C., M. Che, and Y. Ben Taarit

ESR AND IR STUDIES ON THE ADSORPTION AND DISPROPORTIONATION OF NITRIC OXIDE ON COPPER EXCHANGED Y ZEOLITES, AND OF REDUCTION BY CARBON MONOXIDE. *Chem. Phys. Letters (Amsterdam), 13(2):109-112, Feb. 15, 1972. 18 Refs.*

Nitric oxide adsorption on copper exchanged Y zeolites was investigated by electron spin reasonance and infrared measurement techniques. Linde Y type zeolite in the sodium form was base exchanged using a solution of copper nitrate, the concentration of which was calculated to obtain approximately the required exchange level. The exchanged materials were then washed and dried at 110 C. Samples with 2.5, 5.5, 10, and 16 copper ions per unit cell were obtained and then oxygen-treated at 500 C overnight and further outgassed at the same temperature. A Cu(plus)Y form was produced by treatment at 500 C in carbon monoxide. For IR measurements, the solid was compressed into thin discs placed in a sample holder and inserted into a special cell which allowed thermal treatment and adsorption of nitric oxide. For ESR measurements 4 mm OD quartz tubes were used. According to ESR and IR characterizations, the rate of NO disproportionation decreased when the copper content of exchanged Y zeolite increased. Cuprous ions formed by CO treatment of copper exchanged Y zeolite were thus reoxidized by nitrogen dioxide produced by disproportionation. The NO disproportionation was copper concentration dependent as well as NO adsorption which occurred on CO-reduced samples on Cu(2+) ions for low exchanged Y zeolites and on Cu(+) ions for high exchanged Y zeolites. The oxidized form of copper zeolites adsorbed NO to form nitrosyl type compounds. The surface crystal field was directly related to the charge of the copper ion.

24998 **APTIC NO. 46054**

Weston, Roy F. and Cross, Frank L., Jr.

COMPLYING WITH AIR QUALITY STANDARDS. *Preprint, Pennsylvania Chamber of Commerce, Harrisburg, 16p., 1972. (Presented at the Pennsylvania Environment Improvement Conference, Annual, 20th, Harrisburg, Pa., May 19, 1972.)*

The purpose of the Federal air pollution control programs is to protect health and welfare and to enhance the quality of life. The primary ambient air quality standards based on air quality criteria and allowing an adequate margin of safety, are requisite to protect the public health. The standards recognize that health effects are a function of concentration and time. For convenience, the ambient air standards are expressed as 1-year, 30-day, 1-day, and 1-hour averages that shall not be exceeded. The secondary ambient air quality standards, based on the air quality criteria, are requisite to protect the public welfare from adverse effects of pollutants. The secondary standards may be more restrictive than the primary ones. Ambient air quality should be controlled by controlling the emission rates of engineered point sources. A mathematical model, the Air Quality Display Model, has been developed to predict ground level concentrations of a pollutant when emission rates from a source or sources is known along with meteorological data. The AQDM does not account for topographical differences. It can handle up to 1000 individual point sources. It can be calibrated by comparison of model results with ambient air quality and relevant meteorological data. In most cases, primary standards provide ample factors of safety for protecting 100% of the population 100% of the time. Many of the standards are imposed on the states by the Federal Government. In many cases, the state personnel do not like the regulations. This has a serious impact on the creditibility of enforcement. Pollution control administration must satisfy three basic criteria to be successful. They are: reasonableness, equity, and creditibility. The technology of pollution control may be classified as emission cleaning, pollution abatement, and environmental protection. Enforcement cannot meet all three of these requirements utilizing currently available administrative policies and procedures. The achievement of acceptable pollution control is basically dependent on political and economic factors. Economic feasibility of pollution control methods must be attained in order to provide effective abatement of pollution. Acceptable pollution control will not be achieved unless law, programs, policies, and procedures will be changed. (Author conclusions modified)

24999 **APTIC NO. 45421**

Yanagisawa, Saburo

COMBUSTION TECHNOLOGY AND POLLUTION CONTROL. *(Nensho to taiki osen ni tsuite). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 24(9):2-6, Sept. 1972.*

Fuel combustion and air pollution in Japan are described. In 1970, an estimated 1.5 million tons of sulfur dioxides were emitted to the atmosphere, of which 99% came from industries and 1% from automobiles. National regulations state that more than 99% of the hours in an year should have a SO2 concentration below 0.2 ppm; more than 70% of the days in a year should have a daily average below 0.05 ppm; more than 88% of the hours in a year should have an hourly average below 0.1 ppm; and the average concentration during a year should be below 0.05 ppm. The environmental standards for particulates are as follows: for particles smaller than 10 micron in diameter, the hourly concentration should be below 200 micrograms/cu m and the hourly average concentration for 24 consecutive hours should be below 100 micrograms/cu m. The environmental standards for nitrogen oxides and carbon monoxide have not yet been determined.

LEGAL AND ADMINISTRATIVE

1972

25000 **APTIC NO. 45356**

MANDATORY CONNECTION TO AND USE OF REMOTE HEAT. *(Anschluss- und Benutzungszwang fuer Fernwaerme). Text in German. Sanit. Heizungstech., 37(8):516, Aug. 1972.*

Policies regarding the mandatory connection to and use of long-distance heating in different parts of West Germany are reviewed. Communities in North Rhine-Pfalz and North Rhine-Westphalia have had the right to require the use of long-distance heating for many years, but old buildings are exempt from this regulation in North Rhine-Westphalia. The selective application of such regulations has been an option of communities in both Hesse and Lower Saxony since 1971. The imposition of similar regulations is being planned in Bavaria and in Baden-Wuerttemberg, which envisages the possibility prohibiting certain solid or liquid fuels in entire communities or certain sections of them. A reasonable coordination of the use of electricity, gas, and long-distance heating is necessary.

25001 **APTIC NO. 45882**

Tokyo Metropolitan Government (Japan), Bureau of Environmental Protection

AIR POLLUTION (POLLUTION PROBLEMS AND CONTROL WITHIN THE GREATER LONDON AREA). *In: Report on the Tokyo Conference on Environmental Protection, Nov. 8-11, 1971. P. 30-34, May 1972.*

After the great smog of December 1952 which was estimated to have caused the loss of 4000 lives in the London area, effective action was taken to control the amounts of smoke, grit, and dust discharged from chimneys. A Clean Air Act was passed by the British government in 1956 and reinforced by further legislation in 1968. To keep smoke to a minimum it must be consumed by efficient methods of combustion, or avoided by the use of fuels which produce little or no smoke. Large boilers must be equipped with efficient grit and dust arrestors. A minimum chimney height is prescribed before planning permission for new construction is granted, to ensure adequate dispersal of the remaining flue gas constituents, including sulfur dioxide. Air pollution from domestic, commercial, and the majority of industrial premises is controlled by 32 London Borough Councils and by the Corporation of London wich controls a small area in the center known as the City of London. The Clean Air Acts gave priority to the reduction of smoke, and 82% of the program to make Greater London a smokeless city by 1980 has been completed. Pollution by sulfur dioxide is still relatively high in London, but a progressive reduction started in 1965 has reduced the yearly average concentration by nearly 40%. The unpleasant condition of the air in congested streets is causing concern as the numbers of road vehicles increase.

25002 **APTIC NO. 45883**

Tokyo Metropolitan Government (Japan), Bureau of Environmental Protection

AIR QUALITY (A PERSPECTIVE OF ENVIRONMENTAL PROTECTION IN THE CITY OF CHICAGO). *In: Report on the Tokyo Conference on Environmental Protection, Nov. 8-11, 1971. p. 56-60, May 1972.*

The National Air Quality Standards are listed for particulates, hydrocarbons, carbon monoxide, photochemical oxidants, nitrogen oxides, and sulfur oxides, and present air quality in Chicago is compared with the national standards. Sources of pollutants in Chicago, as well as current and future actions designed to achieve air quality, are considered. Chicago plans to meet the 1975 ambient air standard by initiating a motor vehicle inspection program, inaugurating a traffic expediting plan which will increase the average vehicle speed, and encouraging greater utilization of mass transit and discouraging the use of private vehicles. One scheme not yet fully appraised but which other cities have analyzed is the use of a staggered work hour program as a means of reducing congestion in the central urban area.

25003 **APTIC NO. 45884**

Tokyo Metropolitan Government (Japan), Bureau of Environmental Protection

AIR POLLUTION IN TOKYO. *In: Report on the Tokyo Conference on Environmental Protection, Nov. 8-11, 1971. p. 86-98, May 1972.*

Air pollution caused by sulfur dioxide and motor vehicles in Tokyo is considered, including sources, concentrations, health effects, and attempts to control the problem. According to a survey conducted by the Tokyo Metropolitan Government between 1966 and 1968, there are more people suffering from chronic bronchitis in the areas where the concentration of sulfur dioxide is in excess of 0.05 ppm than in areas of lower concentration. Effects of sulfur dioxide upon vegetation are even more evident. A comprehensive air pollution control center is planned for completion in 1973, and will include atmospheric measuring stations, a surveillance network of pollution sources, a communications network with those sources, and electric indicator boards set up on the street. An alert warning system is described, in addition to a shift to low sulfur oil and conversion to gas or electric power. Annual emissions of carbon monoxide, hydrocarbons, nitrogen oxides, and lead from motor vehicles in Tokyo are estimated for 1964, 1965, 1970, 1973, 1975, and 1980. The measures being taken to control motor vehicle exhaust gas are indicated. Photochemical smog is mentioned.

25004 **APTIC NO. 45928**

Stanford Research Inst., Menlo Park, Calif.

REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART I - SUMMARY. (FINAL REPORT). *Environmental Protection Agency Contract 68-02-0207, SRI Proj. 1365, APTD 1122, 88p., Jan. 1972.*

NTIS: PB 210017

The basic premise, site selection, research plan, facility, management, scheduling, and costs of the Regional Air Pollution Study (RAPS) are reviewed. The overall purpose of RAPS is to provide the basis necessary for the formulation of control strategies rather than to develop control and abatement procedures as such. Its relationship to the analytical and decision-making processes in formulating control strategies is illustrated. The capability of mathematical simulation models to describe and predict the transport, diffusion, and concentration of both inert and reactive pollutants over a regional area is evaluated. An attempt is made to develop an improved understanding of the chemical, physical, and biological processes that are entailed in determining the concentration or dispersal of pollutants and the modification of air quality. A better understanding is sought to understand the factors of significance to the design of improved control strategies in the urban/rural complex, including health and economic effects and the role of land use and community planning. Improved technology is sought that can be applied in local and regional control agency operations, including techniques for emission inventories, air quality and meteorological measurement, data handling and analysis, and the objective assessment of effectiveness.

25005 **APTIC NO. 45929**

Stanford Research Inst., Menlo Park, Calif.

REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART II - RESEARCH PLAN. (FINAL REPORT). *Environmental Protection Agency Contract 68-02-0207, SRI Proj. 1365, APTD 1123, 281p., Jan. 1972. 114 refs.*

NTIS: PB 210018

The research plan of the Regional Air Pollution Study is presented according to two methods. The first method provides a comprehensive overview of the three principal components contained in the process of air pollution: meteorological processes, atmospheric chemistry and transformation processes, and the emission sources. The second method defines specific research tasks. Considerations of meteorological processes cover their general involvement and effects on relationships of their magnitudes to air pollution and the manner in which these processes are treated in several mathematical models. The discussion of atmospheric chemistry and transformation processes covers the atmospheric pollutant cycles of the principal pollutants, including sulfur oxides, nitrogen oxides, hydrocarbons, particulate matter, photochemical oxidants, and carbon monoxide. The procedures necessary to develop and maintain a source inventory are presented. Research efforts are indicated within four principal groups: model verification; atmospheric chemical and biological processes; human, economic, and social factors; and transfer of technology. Interaction of the Regional Study with other organizations is considered.

25006 APTIC NO. 45930

Stanford Research Inst., Menlo Park, Calif.

REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART III - RESEARCH FACILITY. (FINAL REPORT). *Environmental Protection Agency Contract 68-02-0207, SRI Proj. 1365, APTD-1124, 185p., Jan. 1972. 4 refs.*

NTIS: PB 210019

The permanent instrument, data-handling, and processing facility planned for the Regional Air Pollution Study is discussed. The St. Louis urbanized area and rural environs were selected as the most appropriate site for the Regional Study. The St. Louis facility is conceived as consisting of a system of air quality and meteorological instrument stations established within an area roughly enclosed by a circle of 100 km radius with the St. Louis arch as its center. A central support facility is also planned, which includes data handling and processing equipment, office and laboratory space, and repair and maintenance shops. Most instrument stations are expected to be linked to the central facility by telephone circuits to permit automated remote data recording at the central facility. Air quality sampling, with respect to pollutant monitoring techniques for carbon monoxide, methane, total hydrocarbons, nitric oxide, total nitrogen oxides, sulfur dioxide, hydrogen sulfide, total sulfur, ozone, and suspended particulates; data acquisition and handling; the mixing layer observation program; general climatology of St. Louis; and land and building requirements are considered.

25007 APTIC NO. 45931

Stanford Research Inst., Menlo Park, Calif.

REGIONAL AIR POLLUTION STUDY: A PROSPECTUS. PART IV - MANAGEMENT PLAN. (FINAL REPORT). *Environmental Protection Agency Contract 68-02-0207, SRI Proj. 1365, 223p., Jan. 1972.*

NTIS: PB 210020

Field data describing air quality, meteorology, and other pertinent factors will be obtained in the Regional Air Pollution Study by an instrument and data processing system unprecedented in the study of air pollutants. Findings are presented which are largely applicable to the scheduling, management, staffing, and the estimated costs of the St. Louis facility. The St. Louis facility is conceived as ultimately consisting of 77 instrument stations and a central facility housing the necessary data handling and processing and remote recording equipment, as well as office, laboratory, and maintenance space for the Regional Study.

25008 APTIC NO. 46195

ENI AND ENVIRONMENTAL PROTECTION IN ITALY. *World Petrol., 43(6):20-22, June-July 1972.*

Italy has been unable thus far to develop and put into effect environmental laws and policies to stop the constant increase of pollution. The only important legislation passed was the so-called anti-smog law of 1966 for controlling the three main types of potential air pollution sources: domestic heating, industrial smoke, and automobile exhaust emissions. Around 1968, however, certain political and cultural circles and large industrial enterprises began to take note of the seriousness of the situation and to work together on remedies. One of the industrial enterprises which began an aggressive attack on environmental problems was the state owned Ente Nazionali Idrocarburi. ENI s first important abatement project was to remove all currently accused pollutants from liquid effluents of the San Nazzaro de Burgondi refinery near Milan. The abatement system is described. To combat degradation of the Mediterranean Sea environment, the ENI Group is currently installing facilities at oil ports for reception and treatment of oily ballast and wash water from tankers. The plan includes specific training courses to build up teams of specialized personnel. Scientific research concerned with automobile exhaust emissions has been going on, and an analytical study of probable costs of eliminating the main causes of air and water pollution was supported. ENI s anti-pollution initiatives were further intensified in May, 1971, through the creation of a new and highly specialized subsidiary, Tecneco, to act as a commercial operator in the abatement field. Tecneco recently introduced a mobile laboratory which is briefly described.

25009 APTIC NO. 46219

THE ACTIVITY OF THE C. T. P. IN ENVIRONMENTAL PROTECTION AREA. *(Le C.T.P. et la protection de l environnement). Text in French. Papier, Carton Cellulose, 21(7):53-55, July 1972.*

The activity of the Technical Center of the Pulp and Paper Industry in water and air pollution control is reviewed. Comprehensive emission measurements were carried out at paper mills with regard to dust, sulfur dioxide, hydrogen sulfide, and other volatile, malodorous sulfur compounds. Methods for the control of smoke emissions from waste-heat boilers are being studied. Recent efforts were concerned with the elaboration of mathematical models for the pulp manufacturing process and of computer programs, suitable for the forecasting of pollution levels and the influence of technological modifications on the pollution.

25010 APTIC NO. 46259

WHY WE NEED AN ENERGY POLICY. *Fuel Oil Oil Heat, 31(8):43-44, 64, Aug. 1972.*

Energy policy was discussed at a Pennsylvania Public Utility Commission hearing. A state energy policy is needed as a means of closing the energy gap. A program of priorities should be set up to insure adequate supplies of oil, gas, and electricity for all persons. The electric utilities created the shortage they are experiencing by their indiscriminate promotion of electric heat in the 60 s. Their use of home heating oil or gas to operate combustion turbines is a most flagrant waste of two valuable natural resources. The gas utilities are pulling their supplies away from the electric utilities so that now practically the entire burden of running these turbines rests with the petroleum industry. It takes approximately four gallons of home heating oil in these combustion turbines to produce the same number of useable Btu s obtainable by directly firing one gallon of oil in a heating boiler or furnace. It has been proposed that no electricity be used for domestic heating and electric water heating and current users convert to other energy sources.

25011 APTIC NO. 45722

Adam, R.

DIVERSE OPINIONS IN THE U. S.: IN THE COMBAT AGAINST WATER POLLUTION AND AIR POLLUTION. *(Meinungsverschiedenheiten in den USA: Im Kampf gegen Wasserverschmutzung und Luftverunreinigung). Text in German. Wasser Luft Betrieb, 16(8):244-246, Aug. 1972.*

According to a cost estimate based on studies by the Department of the Interior, the Department of Health, Education, and Welfare, the Bureau of the Budget, and various economic organizations, $71.3 billion will have to be appropriated in the U. S. over a 5-year-period for combating environmental pollution. The lion s share at $54 billion goes to combating water pollution, followed by $13.1 billion for combating air pollution, and $4.2 billion to improve waste disposal systems. To abate air pollution President Nixon has asked for a tax on pollution by sulfur dioxide, by combustion of oil and coal, by oil refineries, copper melting plants and similar plants. The tax will go into effect in 1976, allowing time for carrying out improvements in existing plants. The tax will amount to 15 cents per pound sulfur in industrial areas and 10 cents in less critical areas. Congress opposes this plan as it opposed an earlier plan to place a tax on the lead content in automobile exhausts. It holds the opinion that such a tax would amount to a license to pollute the air.

25012 APTIC NO. 46095

Alexander, Robert M.

AIR POLLUTION AND THE NEW FEDERALISM. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 19p., 1972. 8 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-40.)*

The major issue of Federal and State pollution control standards, as well as the role of the local governments and control agencies, are discussed. The United States system of federalism has undergone major shifts in recent years. These changes can be observed in the matter of air pollution control. Over the decades, a pattern developed which called for Federal support to state and local governments to aid them in achieving their partisan goals. Now, the state and local governments find themselves in the role of helping to accomplish stated national purposes. In air pollution, national quality standards are set by the Federal government. The states are required to provide implementation of these standards under threat of withholding or withdrawing Federal funds. Grants have increased tremendously since 1958. The initial method was Federal, categorical grants for specific projects and programs, heavily based on sharing of financing. Now, there is a question as to whether or not categorical grants will be replaced by block grants or revenue sharing. Socio-economic changes broght about moving from a traditional to a modern society. Urbanization, industrialization, and the impacts of technology have resulted in a complex mesh of interdependencies which cut across governmental jurisdictions. Many of the problems resulting have become not only national, but international, in scope. Of special interest of this complicated matter of the environment, is the increased role of the judicial system. Historically, the courts have been called upon to deal with pollution through the torts of nuisance and trespass, including assistance to regulatory agencies in their enforcement activities. At the very least, the courts are now forcing governmental agencies to consider a broader spectrum of factors in their decision making process. (Author abstract)

25013 APTIC NO. 45437

Allen, Howard P.

ENVIRONMENT AND ENERGY--WHERE ARE WE, AND WHERE ARE WE GOING? Edison Elec. Inst. Bull., 40(2):84-89, March-April 1972. (Presented at the Los Angeles Breakfast Club, Los Angeles, Calif., Dec. 15, 1971.)

In many cases, government officials and environmentalists are overreacting to threats of environmental pollution, and the effects are delays in construction, economic waste, unnecessary costs, and environmentally counter-productive results. Considering the five stages of the issue attention cycle, the environmental issue is presently somewhere between the third stage, realizing the costs, and the fourth stage, gradual decline of public interest. The public interest has peaked and the domestic and international economy has become the number one political issue for the coming presidential campaign. The electric utility industry in the United States is faced with opposition from all sides, and this is true of Southern California Edison and other electric utilites in Southern California. Due to the recent California Supreme Court decision upholding the authority of Orange County to deny the construction of proposed additions at Edison s Huntington Beach generating station, the future demand for electricity promises to far outdistance the supply. Because of government red tape and other complications in getting permits to construct, which have resulted from lawsuits sponsored by environmentalists, the expansion at the San Onofre nuclear station is faced with at least a 3-year delay. Power plant construction in the Four Corners, New Mexico area is also being impeded by law suits and by the recently passed New Mexico regulation forcing power plant owners to spend more than $30 million to install a bag filterhouse on two of the Four Corners units. The Congress is considering new legislation on water quality which would impose a discharge limitation that would be prohibitively expensive to meet and might be technically impossible to achieve. A one-stop plant siting approval mechanism is needed that will involve a single proceeding at the state level and a single form of proceeding at the Federal level during which all interested parties can present their positions on the issues involved. New energy sources and installations being considered by Southern California Edison are discussed.

25014 APTIC NO. 45449

Banks, O Neil and Al Zirkes

THE ROLE OF THE COMMERCIAL ANALYTICAL SERVICE IN SOLVING WIRE INDUSTRY AIR AND WATER POLLUTION PROBLEMS. *Wire J., 5(8):40-42, Aug. 1972. (Presented at the Wire Association, Annual Meeting, 41st, Cleveland, Ohio, Oct. 1971.)*

Whether in field sample collection, analytical work, air monitoring programs, or water analysis, problem solving involves a large amount of laboratory testing. In general, there are three types of environmentally oriented laboratories: governmental laboratories, industrial laboratories, and the independent, private, or commercial testing laboratory. There are four major areas where a commercial testing laboratory performs an indispensable service and offers unique solutions to the environmental pollution problem. The commercial testing laboratory can be professionally impartial, and offer the expertise of trained people dealing with specific types of problems. An independent laboratory can justify costs for highly specialized test equipment which a corporation or a governmental laboratory may not be able to justify. The fourth advantage of the commercial laboratory is in the economics it offers, for example in the efficiencies realized by mass performing analyses.

25015 APTIC NO. 45447

Calvert, Seymour

ENVIRONMENTAL CONTROL. *Chem. Engr. (London), 50(262):231-233, June 1972.*

In the face of increasing amounts of pollution it is logical that some more rapid and effective means of controlling pollution be developed than waiting until effects are felt. This requires the ability to anticipate the effects of air contamination. The first step in relating effects to air composition is to develop air quality criteria, which more accurately should be called air quality corollaries. These are the cause-effect relationships between various concentration-duration exposures to air pollution and effects of all types on receptors of all types. The next step of the control agency is to establish air quality standards based upon the air quality criteria along with any other factors which may be weighed in the balance to determine the best course of action for society to take at a given time. The approach to air pollution control in the United States is considered, including control legislation and national air quality standards. The role of the chemical engineer in environmental control is defined, and the importance of cost estimates is cited.

25016 APTIC NO. 45726

Cocconi, Luigi

THE POLLUTION CONTROL CENTER OF THE PROVINCIAL ADMINISTRATION OF MODENA. *(Il centro antinquinamenti dell amministrazione provinciale di Modena). Text in Italian. Nuova Chim. (Rome), 48(7):83-85, July 1972.*

The first fully automatic pollution control center in Italy was recently inaugurated in Modena. The station is equipped with five autoanalyzers; the equipment and installation cost $17 million. The center serves as a technical consulting service for public health authorities of the surrounding communities; formulates and conducts research, especially in the field of pesticides and herbicides; conducts courses for pollution technicians; and holds periodic meetings with technical personnel from other communities to permit coordination of their activities. Autoanalyzers perform determinations of aluminum, boron, bromides, calcium, carbon dioxide, chlorides, chlorine, chlorine dioxide, chromium, copper, cyanides, fluorides, water hardness, iodides, iron, lithium, manganese, nitrogen, ammonia, nitrites, nitrates, organic nitrogen, chemical oxygen (COD), alkalinity, phenols, orthophosphates, total phosphates, potassium, silicon, sodium, sulfites, sulfides, sulfates, turbidity, zinc, mercury, and residual pesticides. Another autoanalyzer monitors sulfur dioxide, nitrogen oxides, formaldehyde, and hydrogen sulfide. The equipment comprises a portable oxygen monitor, a gas chromatograph, a colorimeter, portable automatic sampling equipment for suspended particulates, portable sampling equipment for gaseous pollutants, an atomic absorption spectrophotometer for the determination of metals in dusts, a cell for spectrophotometric determination of carbon monoxide, a portable aspirator pump, an analytical balance, and a pH-meter. A mobile station housed in a truck is equipped with conventional monitoring instruments and a complete meteorologic station. The task of the station is to monitor all pollution sources in the province, to draw microclimatic maps, to identify sites of pollution accumulation, and to look for correlations between pathological phenomena reported and pollutants.

25017 **APTIC NO. 45956**

Cross, Frank L., Jr. and William K. Davis

ESTIMATION OF ENVIRONMENTAL IMPACT FROM POINT SOURCE AIR POLLUTION EMISSIONS. *Preprint, Regional Science Assoc.; Philadelphia, Pa., 22p., 1972. (Presented at the Northeast Regional Science Association Conference, University Park, Pa., April 14-16, 1972.)*

Site selection embraces analyses of the physical, economic, social, cultural, and governmental characteristics of the areas in question. Each principal characteristic should be evaluated not only for the impact of the point source on the existing situation, but also to determine the response pattern or subsequent effect of the installation. The Israel Electric Corporation considered several sites between Haifa and Netanya as the location of a new conventional power plant, scheduled to begin operations in 1976. Evaluation of the environmental impact involved consideration of air quality, land use, oil spills, thermal pollution, and noise. The investigation included inspection of the primary government officials, review of pertinent records, application of a mathematical model for predicting air pollution concentrations, and development of a quantified rating system for assessment of the various environmental impacts and comparison of the proposed sites. Four source locations were investigated. Receptor points were located on a grid system throughout the region. Model outputs for projected particulate and sulfur dioxide emissions on annual and seasonal basis were plotted as isopleths of equal concentration for comparison purposes. Hadera appeared to be the most favorable of the proposed sites. The impact of sulfur dioxide emissions from Hadera would be minimal on an annual average. Concentrations estimated are only contributions from the proposed power plant at each location and do not include a background level from sulfur dioxide in the area concerned. (Author conclusions modified)

25018 **APTIC NO. 45767**

Friedlander, Gordon D.

FORD, FUELS, AND YOUR FUTURE. *IEEE (Inst. Elec. Electron. Engrs.) Spectrum, 9(8):59-60, Aug. 1972.*

The Ford Foundation has funded a $2,000,000 Energy Policy Project to focus on the issues of long-term planning. The Project is intended to develop a compendium of impartial, well-documented data to attain its major objective: the creation of a comprehensive basis for policy analysis. Basic facts about energy supply and demand are either missing or in dispute; facts about fuel reserves are withheld by both industry and government; and basic fuel-cost information is simply not available. The Washington staff will develop an overview, which will outline the physical systems of producing and distributing energy (with emphasis on the policy-making apparatus) and the facts about energy supply and demand. The overview will describe how energy affects the environment and the life styles of people, and the legal structure under which the power industry operates. As its top priority, the overview will delineate the policy and decision-making process in the Federal government, in the state regulatory agencies, and in industry. Trends of the evolution of the energy system in the future will be illustrated. Scenarios will explore the energy-environment system in 1985 with costs and use of fuel and technologies as variables. Another scenario will project to 1985 assuming less than predicted growth, and dealing in addition with socio-economic effects of reduced energy growth-demand. The project will explore efficiencies in use and production; future costs; measures of environmental impact; need for public information; Federal resource, management; and land use. Present policies are contradictory and outmoded. The best solution would be joining Government and industry s efforts.

25019 **APTIC NO. 45656**

Haering, Hans-Ulrich

THE ACTIVITIES OF THE OPERATIONS RESEARCH INSTITUTE IN THE FIELD OF ENVIRONMENTAL PROTECTION. *(Taetigkeit des Betriebsforschungsinstitutes im Bereich des Umweltschutzes). Text in German. Stahl Eisen (Duesseldorf), 92(16):796-797, Aug. 1972.*

The Operations Research Institute has recently been included in the list of neutral institutes (according to paragraph 25 section 2 of the industrial regulations) entitled to take measurements of air pollutants (smoke, soot, dust, gases, vapors, and odors), noises, and vibrations on all facilities of the iron and steel industry. The Institute carries out research tasks and furnishes expert opinions. One recent example of the Institute s activities in the field of environmental protection is the study of dust collectors for electric steel plants.

25020 **APTIC NO. 45635**

Krotkov, F. G.

SCIENTIFIC AND TECHNOLOGICAL ADVANCEMENT, ENVIRONMENT AND MAN. *(Nauchno-tekhnicheskiy progress, vneshnyaya sreda i chelovek). Text in Russian. Gigiena i Sanit., 37(16):3-9, 1972. 2 refs.*

General problems of environmental pollution as a consequence of civilization and technological advancement, and environmental protection measures taken in the U.S.S.R. are reviewed. A relationship between air pollution and the increased number of colds, bronchitis, pneumonia, emphysema, and bronchial asthma has been established. Improvements in technological and combustion processes, changeover from solid to gaseous fuels, the use of unleaded gasoline in big cities, and adequate land planning are among the principle measures available to reduce air pollution. Noise, dangerous above 80 dB, may reach values up to 80-90 dB in big cities. Forecasts for the next decade predict global decrease of air pollution in the U.S.S.R. despite a great number of new industrial plants to be completed during this above period. Industrial decentralization is increasing; such dispersion of factories over the huge area of the country is one of the most effective ways of avoiding high pollution levels. Maximum allowable concentrations of 114 air pollutants and 24 basic pollutant combinations have been determined. Investigations revealed normal morbidity rates for children for pollutant concentrations below the maximum allowable values. Hygienic and epidemiologic services throughout the country continue to play a major role in environmental protection. Examples of successful initiatives taken by industries to control pollution show an increasing trend towards closed cycle processes with recovery and utilization of valuable materials, as well as the use of high stacks.

25021 **APTIC NO. 46241**

Lincoln, R. H.

AN ENGINEERING APPROACH TO SOLVING ENVIRONMENTAL PROBLEMS IN CONSUMER PRODUCT INDUSTRIES. *Preprint, Society of Automotive Engineers, Inc., New York, 5p., 1972. 5 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 10-14, 1972, Paper 720167.)*

Environmental problems which confront today s consumer product-oriented industries can be critically analyzed and systematic plans can be made to attack each problem. A system is described which permits analysis of problems and rank ordering of action alternatives in areas of environmental concern. Major areas of concern--such as air, water, noise, and land pollution, product safety and liability, and consumerism--are considered as each relates to specific problems. Detailed problems within each area of concern are listed and studied according to their current, short term, and long term significance. Action alternatives are proposed for every detailed problem. Feasibility of solutions must take into account much more than technological and economic factors. For example, ecological and esthetic effects must also be considered and weighed. A charting system is illustrated which can be adapted to any industry s needs. Tables are presented which represent the combined and condensed judgment and the best thoughts of all people whose corporate activities may be related to each phase of a problem-activities such as quality control, marketing, engineering, service, manufacturing, advertising, and legal function. (Author summary modified)

25022 **APTIC NO. 46361**

Mathe, Peter

THE FEDERAL LAW DRAFT FOR PROTECTION AGAINST AIR POLLUTION AS A CONTRIBUTION TO PROTECTION OF LIFE AND TO PREVENT DESTRUCTION OF THE ENVIRONMENT AND ENVIRONMENTAL RISKS. *(Der Entwurf des Bundes-Immissionsschutzgesetzes vom 31.8.1971 als Beitrag zur Vorsorge gegen Umweltzerstoerung und zur Abwehr der Umweltgefahren (eine kritische Stellungnahme zu einzelnen Ausfuehrungen). Text in German. Staedtehygiene (Uelzen/Hamburg), 23(8):196-199, Aug. 1972. 20 refs.*

It is applaudable that the drafted emission protection law attempts to close gaps that existed between laws on the state and federal level in the Federal Republic of Germany. The law is addressed to all polluters, even those whose pollution becomes apparent only in combination with other pollutants. The polluter-pays-for-the-clean-up-principle has received legal basis now. All protective measures are welcomed. Harsh fines await the disobedient. The interests of those directly affected by the emissions of a stationary or mobile source are represented by scientists, economists, the health department, unions, and by state employees. The licensing of plants is tied to the application of the latest and newest technology in the design and construction and equipment. The good health of the residents in industrial centers is seen as the ultimate goal.

25023 **APTIC NO. 46124**

McLin, Jon

STEPPING ACROSS BOUNDARIES. *Environment, 14(4):16-22, 27-28, May 1972. 8 refs.*

It must be recognized that environmental problems have an international character. This is more easily demonstrated in Europe than in the U. S. or the U.S.S.R. Many of Europe s major international rivers and inland seas have deteriorated badly. The Economic Commission for Europe is a regional body of the U. N. and is the only major intergovernmental body, including East and West European countries and the U. S. in its membership. It was the first European agency to become involved in environmental issues but has been stymied by the question of representation for the German Democratic Republic. So far it has been unable to act. The Council of Europe is an organization with a certain status but little power; N.A.T.O. is a forum with power in its 15 member capitals and must be part of any solution. The Organization for Economic Cooperation and Development has set a goal of qualitative growth for the 1970 s and may, through reorganization, make headway; it has 22 member nations. The European Economic Community shows the most potential for effective environmental action, since it alone is empowered to pass legislation that is directly applicable and enforceable in the member countries. So far the governments have been too preoccupied with the establishment of their own national environmental policies to have given too much attention to the international agencies.

25024 **APTIC NO. 45452**

Moore, Joe F.

DELEADING CAN HAVE ANTITRUST IMPLICATIONS. *Oil Gas J., 70(32):45-47, Aug. 7, 1972. 1 ref.*

There are indications that gasoline deleading may hold some profound implications for the domestic oil industry that go beyond the immediate impact represented by added investment in refining and marketing facilities. Major oil companies appear to be facing a strange paradox. They can compete strongly within the availability of their resources and risk antitrust action aimed at divorcing refining and marketing if this vigorous competition restricts or significantly damages the independent refining and marketing sectors of the industry, or they can hope to avert antitrust actions by restricting their competitive actions to preserve the present balance between majors and independents as economic gasoline suppliers. Only a truly competitive supply picture, with regard to both crude oil and gasoline, will assure consumer interests that concentration of economic power in the oil industry is not running against the public welfare.

25025 **APTIC NO. 45630**

Murai, Saburo

ENFORCEMENT OF BAD ODOR CONTROL LAW. *(Akushu boshi-ho no shiko ni yosete). Text in Japanese. Akushu no Kenkyu (Odor Research J. Japan), 2(7):1, Aug. 1972.*

In many cases, a bad odor is generated from several combined substances, and this gives rise to problems in the determination of control regulation. Ammonia, methylmercaptan, hydrogen sulfide, methyl sulfide, and trimethylamine are cited as offensive odors, and subject to control in the newly issued Japanese regulation effective May 31, 1972. The development of measurement methods for odor concentrations is needed in order to establish environmental standards.

25026 **APTIC NO. 45440**

Muskie, Edmund S.

THE GLOBAL ENVIRONMENTAL CRISIS. *Environ. Affairs, 11(1):172-179, Spring 1972.*

There is a clear need for a global environmental program in which all sovereign states are made responsible to the international community for actions which produce international environmental effects, but the development for a global environmental program will require a firm commitment to global cooperative action by every nation of the world. As an industrialized nation that pollutes disproportionately, the United States cannot, in good faith, encourage or expect others to give priority attention to environmental matters unless it is willing to do so itself. The United States must take the initiative in international policy making activities. Efforts being made by the United States, with respect to systems and policies for national environmental management, provide a model for environmental proposals that may be offered to members of the world community. Trade policies should be adjusted so that they respond to any advantages that foreign nations might have because of less stringent standards, regulations, or controls. The United States should take the initiative in urging the creation of an international technical assistance program, to be staffed with top scientists, technologists, and engineers experienced in environmental control. Such a group would be available to the developing nations. All multilateral environmental agreements to which the United States is a party, must be brought before its own legislatures for enactment into domestic legislation.

25027 **APTIC NO. 45400**

Ohira, Toshio and Mitsuru Utagawa

AIR POLLUTION MEASUREMENT AND DATA HANDLING SYSTEMS. *(Taiki osen no sokutei to deta shori). Text in Japanese. Bunseki Kiki (Analysis Instr.), 10(9):577-587, Sept. 1972. 7 refs.*

The location, function, and operation of air pollution monitoring stations are discussed along with data handling systems. In addition, Japanese environmental standards for sulfur oxides, carbon monoxide, and particulates, and measurement results at several nonpolluted areas in Japan are given. Information on the degree of pollution, the patterns of change of pollution, the characteristics of meteorological conditions and ground shape, and the distribution of pollution sources is important for establishing monitoring stations. Japanese national regulations state that a combined monitoring station must be equipped with apparatus for measuring sulfur oxides by the conductivity method, nitrogen oxides by the Saltzman method, total hydrocarbon by the flame ionization detector method, oxidants by the neutral potassium iodide colorimetric method, and particulates by the light scattering method, plus, high and low-volume samplers and data transmission apparatus.

25028 **APTIC NO. 45378**

Pavlov, A. V.

INFORMATION IN THE SERVICE OF ENVIRONMENTAL PROTECTION AND SANITATION MEASURES. *(Informatsionnoye obespecheniye komplexa meropriyatiy po okhrane i ozdorovleniyu vneshney sredy). Text in Russian. Gigiena i Sanit., 37(16):54-56, 1972.*

General problems and tasks involved in the planned automation of the control and planning of the activity of all sanitary institutions in the USSR within the next 5-7 years are outlined. A new system is planned to cover all sanitary and epidemiological stations and to provide central processing of data on the efficiency, character, and extent of hygienic and epidemiological measures, the hygienic and epidemiological conditions in the country, the degree of environmental pollution, and the results obtained by the individual research institutions. All materials will be collected, screened, generalized, and evaluated for use in a complex environmental study.

25029 **APTIC NO. 45367**

Pongrace, Otto W.

THE TOTAL SYSTEMS TECHNIQUE: UNEMOTIONAL AMMUNITION TO WIN ENVIRONMENTAL POLLUTION WAR. *Ind. Develop., 141(3):5-10, May/June 1972.*

The total systems concept of pollution control involves the application of the Critical Path Method (CPM) to four Performance Evaluation and Review Technique (PERT) programs that are based on the four basic categories constituting the pollution problem: air, land, water, and the population explosion. The CPM means planning, scheduling, and controlling a project. Applying the method to PERT requires an intensive review and analysis of the environmental antipollution situation: the events that have taken place; the progress that has been made; legislation and its subsequent interpretation and application; the compliance with or enforcement of the identifiable and measurable requirements; and the development of a balanced eco-system. The importance of instrumentation for PERT programs is stressed and the CPM is contrasted with present unrealistic standards for which engineering and science cannot provide solutions in the time allotted. While the CPM and a total systems program mean years of instrumentation designing, engineering, manufacturing, and standardization, the two will provide for the simultaneous reduction of every source of pollution.

25030 **APTIC NO. 45766**

Rossin, A. David and John J. Roberts

EPISODE CONTROL CRITERIA AND STRATEGY FOR CARBON MONOXIDE. *J. Air Pollution Control Assoc., 22(4):254-259, April 1972. 7 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 64th, Atlantic City, N. J., June 1971, Paper 71-55.)*

Approaches to controlling carbon monoxide pollution episodes due to meteorology and traffic are outlined which are based on the relation between the CO concentration and the level of carboxyhemoglobin (I) in the blood. The higher the CO, the faster carboxyhemoglobin builds up; by returning to pure air the carboxyhemoglobin level rapidly decreases. The levels may range between 3.7 to 7% carboxyhemoglobin. At 7%, substantial endangerment to health can occur, especially in the case of persons with heart disease. At a 5% level in nonsmokers, visual impairment and poorer response in reaction time to test stimuli occurs. Levels of 20 ppm for 3.7% carboxyhemoglobin, 25 ppm for 4.5%, and 40 ppm for 7% correspond to level 1, level 2 alert, and level 3 emergency, respectively. The three levels are part of a forecast strategy and alarm system. Forecasts are made daily. If the forecast indicates almost 7%, regardless of whether or not an alert has been declared, CO emergency is declared, and feasible action steps are taken. An episode control strategy has been designed with the objective that nonsmokers are not to be exposed to high enough levels of carbon monoxide for a long enough time to develop 5% carboxyhemoglobin. Forecasts are made taking into account meteorology, predictable traffic density variations, and effective exposure time for people. Forecast factors are monitor population ratio and the effective exposure time. Residential areas are assumed to be continuously exposed. Commercial or industrial areas are exposed during working hours. The location, traffic situation and traffic severity are evaluated and control actions initiated. In the event of emergency, traffic is restricted to authorized vehicles only, public announcements are made, police are called upon for traffic control, and sometimes entire areas are evacuated in a drastic strategy, a measure justifiable for sustained levels of carbon monoxide over 150 ppm. Only long-range transportation planning will reduce health hazard and will ensure effective traffic control.

25031 **APTIC NO. 46386**

Roth, Christian

PROGRAMS BUT NO PLANS. THE IDEA OF PLANNING AS SHOWN ON THE EXAMPLE OF ENVIRONMENTAL PROBLEMS. *(Programme, aber keine Plaene. Zum Planungsbegriff am Beispiel Umweltprolematik). Text in German. Umwelt (Duesseldorf), 2(4):14-19, 1972.*

The environmental program of the Federal Republic of Germany will have a rather unfavorable effect on the environment because it is a typical example of how a program without a realistic approach provides a temporary solution to a pressing problem without heading off a crisis situation. All it does is lull everybody involve into the feeling of having done something. The environmental program hardly reaches beyond one legislative period, or cuts into other areas. What is required is an extensive plan for all fields of environmental pollution with a common goal. This overall plan can be divided into individual plans. The overall plan is entirely future oriented and determined by the future, while the individual plans are worked out based on past experience. Entirely new and non-forseeable developments might render an individual plan dispensable while such developments will not affect the overall plan.

25032 **APTIC NO. 46372**

Schenkel, Werner and Gerhard W. von Velsen

THE PROBLEM OF INDUSTRIAL WASTE DISPOSAL. *(Zum Problem der Beseitigung von Sondermuell). Text in German. Chem.-Ing.-Tech., 44(16):962-966, 1972. (Presented at the Internen Arbeitssitzung des VTG-Dechema-Fachausschusses, Beseitigung von Industrierueckstaenden, Kniebis/Schwarzwald, West Germany, Nov. 22-23, 1971.)*

The social, organizational, and economic problems of industrial waste disposal are outlined in the light of the legal situation. The possible ways of organizing the disposal of special waste are by the state, by private industry, by the state with aid from private industry, and by private industry with aid from state. They are compared and contrasted regarding advantages and disadvantages of each alternative. A scheme is outlined for the region covered by the Siedlungsverband Ruhrkohlenbezirk (SVR) which is based on the construction of a large plant for disposal of special waste by industry with participation of the SVR. The newest laws and drafts of laws on the various levels agree on two principles, the prohibition of the entry of polluted water into a receiving stream and into the groundwater, and the prohibition of the emission of polluting gases. The producer of the waste material has to take care of its disposal. Refinements of this position are necessary should dire consequences be avoided. A distinction between primary and secondary emissions is necessary. Primary emissions such as those developing during combustion contribute 30 to 40% to the total emission. Secondary emissions, which are produced through the use and consumption of goods cause 60 to 70%. Much has been done for the reduction of primary emissions as the example of the sulfur dioxide emissions shows. A carefully balanced distribution of the costs among consumers and the public is needed for the elimination of secondary pollution.

25033 **APTIC NO. 46190**

Sirola, Josip

WHICH ARE THE POSSIBILITIES FOR THE DECREASING OF LEAD IN PETROL. *(Mogucnosti za smanjenje olova u benzinu). Text in Yugoslavian. Nafta Broj, 7(23):321-327, July 1972. 7 refs.*

The possibilities for decreasing the lead in gasoline are discussed. Lead alkyls are added to gasolines to improve their resistance to knocking, and their complete elimination could not be expected at the present time without affecting gasoline quality, especially with regard to octane number and volatility. One problem is the enormous investments which would be necessary to modify oil refining technology. Due to different characteristics of the motors and oil refining technology, the method of solving this problem differs in Europe from that in the United States. In Yugoslavia, as elsewhere in Europe, it will only be possible to decrease the amount of lead in gasoline by a joint action of the oil refineries and the automobile industry. It may be possible to reduce the lead in the unused oil refinery quantities, which, with a greater variation in the prices for the gradations of gasoline, might contribute to the success of this action.

25034 **APTIC NO. 45590**

Smith, William A.

NOISE CONTROL LEGISLATION. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 22p., 1972. 18 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-22, 1972, Paper 72-151.)*

The national Environmental Protection Agency (E.P.A.) is expected to issue its recommendations on noise legislation some time during the latter part of 1973. This agency will assume primary responsibility for enforcing noise limits on new products, such as vehicles, construction equipment, and electrical equipment. Primary responsibility for community noise control will remain with local governments. Local E.P.A. s, now involved in air and water pollution, will be given the additional responsibility to enforce anti-noise legislation. This legislation will cover noise emissions from vehicles, industries, construction equipment, residential air conditioners, and power equipment, and the noises that pervade multifamily dwellings. Responsibility for controlling aircraft noise will be shared with the Federal Aviation Authority. The noise ratings used in this legislation must be capable of easy measurement, and yet correlate well with subjective response. For most noises the decibel level read on the A-scale of a sound level meter (dBA) is adequate. For aircraft noise, a more complex rating scale must be used which includes consideration of the duration of the noise and the presence of a pure tone (engine whine). For still other noises (industries, construction) some consideration must be given to the total daily exposure time of the noise, along with its dBa rating. New community noise ordinances will draw on the research and experience associated with the present Chicago ordinance. Some modifications of this ordinance are expected, however, to improve enforcement procedures and to lower vehicle noise levels, which are considered the worst of all the community noise pollutants. (Author abstract modified)

25035 **APTIC NO. 45911**

Stockton, Edward L., Peter Wege, Philip Nunn, and Ronald Gall

CITIZEN PARTICIPATION IN AIR QUALITY MANAGEMENT. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 17p., 1972. 3 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 65th, Miami, Fla., June 18-20, 1972, Paper 72-184.)*

The National Sanitation Foundation of Ann Arbor, Michigan in cooperation with a Grand Rapids citizen organization the Center for Environmental Study has designed and implemented a program to involve area citizen directly in air quality management. An air pollution task force group has evaluated the current status of air pollution, adequacy of regulations, level of enforcement staffing, and present monitoring employed. Deficiencies have been noted. Special consultant reports to municipal officials have been prepared. A community attitude survey was performed to assess public concern. The citizen group has been shown how to employ systems methodology and computer simulation in planning comprehensive programs for air quality management. This methodology is transferable to other communities. The technique also lends itself to studies for industry to test the effect of air emissions on the community, or to test probable community reaction to air pollution from industrial facilities when combined with auto emissions and other background air pollution. Plant siting problems might be minimized by simulation studies. This comprehensive mathematical computer model is comprised of data relating to past and present air quality, health, fixed sources, mobile sources, dispersion model, demography, economics, political and social concerns. A computer terminal, connected to a large time-sharing computer in Stamford, Connecticut, is utilized to graph hypothetical policies and practices for citizen review. Alternatives are readily and inexpensively produced by selecting alternate data from within the 1000 variables stored in the computer. Graphic results are displayed over television and interpreted with the aid of vu-graphs for public reaction. The public is better informed to participate actively in decision making for an optimum air quality management program. It is anticipated that this comprehensive plan will both receive majority approval of the citizen who designed the plan and will produce excellent long-lasting results. (Author conclusions modified)

25036 **APTIC NO. 45406**

Takano, Masayoshi

LAW ENFORCEMENT FOR BAD ODOR CONTROL. *(Akushu boshiho no shiko ni tsuite). Text in Japanese. Akushu no Kenkyu (Odor Research J. Japan), 2(7):2-7. Aug. 1972.*

Odor control regulations were issued by the Japan Environmental Agency, effective May 31, 1972. The regulations stated that offensive odors subjected to control, which are the main cause of public nuisance, should be measured. Five substances including ammonia, methyl mercaptan, hydrogen sulfide, methyl sulfide, and trimethylamine fit the above definitions. The main sources of these odors are fish meal manufacturers, fertilizer manufacturers, petroleum refineries, and waste water treatment plant. The ranges of the concentration standards were set at 1 to 5 ppm for NH_3, 0.002 to 0.01 for CH_3SH, 0.02 to 0.2 ppm for H_2S, 0.01 to 0.2 ppm for methyl sulfide, and 0.005 to 0.07 ppm for trimethylamine based on the six degrees of odor strength indication.

1971

25037 **APTIC NO. 45553**

ENVIRONMENT AND NUISANCES IN THE SAINT-ETIENNE INDUSTRIAL COMPLEX. *(Environnement et nuisances dans le complexe industriel stephanois). Text in French. Nuisances Environ. (Paris), no. 1:51-58, Feb. 1971.*

Environmental nuisances in the Saint-Etienne industrial complex, as well as initiatives taken or planned by communal authorities and industries, are reviewed. Metallurgy, coal mining, and textile manufacturing are the basic industries in the Saint-Etienne region which contribute to the occurrence of serious air pollution conditions. Municipal authorities, unable to curb industry-generated pollution, set up a large-scale sanitation program including such projects as rezoning of urban and industrial areas, the creation of green belts, as well as boiler and automobile inspections. Initiatives by industries to abate environmental nuisances are both sporadic and inefficient. Several metallurgic plants, including foundries, fail to use adequate dust separators, although means applied to control indoor air pollution are usually satisfactory. Stacks higher than 100 m and electrostatic dust precipitators with efficiencies of 96-97% are applied at thermal power plants, and the use of electrostatic dust collectors with 99% efficiency is envisaged. The problem of dust emissions from handling and transportation of coal and combustion residues has been solved satisfactorily. Air pollution from domestic heating shows a downward trend as a result of a steady decline in coal consumption.

25038 **APTIC NO. 45460**

Chen, Kan

A MACROSYSTEM ANALYSIS OF THE HUMAN ENVIRONMENT. *J. Environ. Syst., 1(2):133-152, June 1971. 22 refs.*

The world macroproblem has been identified and assessed by biologists, ecologists, engineers, economists, futurists, and scientists and humanists of many different disciplines. The ingredients of the problem are usually perceived to include the exploding growth of population, technology, and ecomony, and the resultant pressure on ecology, natural resources, and all aspects of the human environment. There is a need for integrating the views and proposed solutions of the various ecologists and scientists in a common framework to facilitate public debate and policy decisions. A possible framework for such macrosystem analysis is illustrated. It includes population and economic variables, as well as assumptions, projections, effects, requirements, constraints, alternatives, and policy decision processes. A range of assumptions would include current growth trends, their reasonable variations, and some drastic changes that have been proposed seriously, while projections would be made on population and economic growth patterns based on each set of assumptions. Effective ways of linking policy research to policy decisions would be explored to increase the probability of their use. (Author conclusions modified)

25039 **APTIC NO. 45555**

Gousset, P.

THE ACTION AGAINST NUISANCES AS CONDUCTED SINCE THE DEBUT OF INDUSTRIALIZATION. *(L action contre les nuisances depuis l origine de la civilisation industrielle). Text in French. Nuisances Environ. (Paris), no. 1:83-85, Feb. 1971. 9 refs.*

The history of the struggle against environmental nuisances in France is outlined, and current French legislative measures against environmental pollution are reviewed. Damages from environmental nuisances increase with the degree of urbanization, industrialization, traffic, population, traffic density, living standards, and technological advancement, whereas an abundance of space, water, and vegetation as well as highly developed preventive techniques are reducing factors. Legislative regulations in matters of environmental protection cover communities, construction projects, health and accident prevention, industries, and transportation. The establishment of industrial plants is subject to official authorization, and administrative sanctions are provided for violations of environmental protection regulations.

25040 **APTIC NO. 45655**

Kobayashi, Kazuo

INFORMATION PROCESSING AND PROBLEMS ON THE BIBLIOGRAPHY OF ENVIRONMENTAL POLLUTION. *(Kankyo kogai bunkenshu no hensei to naiyo ni tsuite no shomondai-ten.) Text in Japanese. Joho Kanri (Inf. Doc.), 14(5):299-315. Aug. 1971.*

The information processings on the bibliographies of environmental pollution in the U. S. and Japan are described. In addition to the Pollution Abstracts, Air Pollution Abstracts, and Water Pollution Abstracts, there are also selected references on environmental quality, which relate to human health, being published in U.S.A. In Japan, the information activity, which is the basic requirement for pollution control, has been started late. Abstracts of Researches on Public Nuisance I which includes air pollution, agricultural products, and water pollution, has been published by the Ministry of Agriculture and Forestry from 1969. From 1971 to 1972, six volumes of the collections of Bibliographies on Public Nuisance were also published. The collections are divided into three fields: science and engineering, medicine, and agriculture.

25041 **APTIC NO. 45541**

Rebiere, Andre

LEGISLATION AND REGULATIONS CONCERNING ATMOSPHERIC POLLUTION. *(Legislation et reglementation en matiere de pollution atmospherique). Text in French. Pollut. Atmos. (Paris), vol. 13:60-63, May 1971.*

Legislative measures and regulations adopted in France to control air pollution are reviewed. Legislation concerning combustion-generated air pollution provides possibilities for establishing technical specifications on heating equipment, for municipal intervention during serious pollution episodes, and for the creation of special protection zones. Coals with volatile contents higher than 15% and fuel oils with sulfur contents exceeding about 2% must not be used in Paris, where heating equipment with capacities above 350 thermes/h are subject to annual inspection. Muncipal authorization is required for industrial units. Guidelines on necessary stack heights and permissible emissions from cement works, waste incinerator plants, and ore agglomerating plants are elaborated. Specifications were issued for thermal power plant emissions and maximum allowable smoke density and exhaust emissions of cars at idle and during normal drive conditions. Catalytic exhaust gas afterburning, requiring the use of no-lead gasoline, is regarded as a promising method to reduce exhaust emissions.

25042 **APTIC NO. 45602**

Salama, Abdo Ovadia

STOCHASTIC CONTROL AND MULTILEVEL COORDINATION MODELS FOR AIR QUALITY MANAGEMENT WITHIN A REGION. *Pennsylvania Univ., Philadeplphia, Dept. of Environmental Sciences, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1971, 157p. 27 refs.*

The manner in which optimal control theory and hierarchical multilevel system theory can be applied to some aspects of air quality control problems within a region or city was examined. The overall goal of the derived air quality management model is to keep concentration of pollutants in the atmosphere during any time period lower than a given level, whatever the meterological conditions may be. The overall constraint of the model is to keep the output of the production sector the same as it would be if this sector were not affected by the pollution concentration limits. The optimal control must specify how the system, consisting of all the polluting plants, should be set to operate at the beginning of every time period. Changes in weather conditions are assumed to follow a Markov process. The first part of the research was limited to the study of the case of a single plant s decision problem. An algorithm developed for practical computations led to the optimal decision. In the second phase of the study, the algorithm was applied to the case in a central agency monitoring the use of abatement equipment of all plants in a region. Ways in which decision-making responsibility can be shared amoung a monitoring agency and individual plants are explained. A taxation policy can be found which induces the plants to adhere to such a scheme.

SOCIAL ASPECTS

1972

25043 **APTIC NO. 46194**

DUTCH DEMONSTRATORS PUT PRESSURE ON POLLUTERS. *Chem. Week, 111(8):35-36, Aug. 23, 1972.*

Public pressure and new antipollution laws are making it tough to get clearance to open new plants in the Netherlands--and making it more expensive to build and operate them, once clearance has been obtained. Industry experts estimate that concern about pollution has turned away more than $1 billion worth of industrial investments. One big project turned down in the Rotterdam area was a $190 million plant proposed by a German steelmaker. Several other projects which have fallen victim to antipollution demonstrators are cited. The company that has had perhaps the toughest time of all in the Rotterdam area is Gulf Oil, and its attempts to deal with its pollution problems and public complaints are described.

25044 **APTIC NO. 45458**

Fisher, Joseph L.

ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION: TECHNOLOGY AND PUBLIC POLICY. *Prof. Eng., 42(8):43-45, Aug. 1972.*

During the closing years of the 1960 s, more and more people began to ask why the United States, with all its technology, business enterprise, and finance, could do a better job of improving the natural environment. Hopefully the 1970 s will be characterized by a synthesis of development with environmental protection across a broad front of human concerns and working through a variety of programs and institutions. Modes of behavior will have to change, as will the private and public institutions through which human activity is increasingly expressed. New theories and methods of analysis will have to be developed as a means of projecting the consequences of present economic and population trends as they bear upon both the natural and social environment. Resources for the Future has recently been examining systematically the raw material and environmental consequences of several possible rates of population and economic growth in this country to the end of this century and beyond. A comprehensive statement of energy research needs is being drawn up, and a program of studies is being directed toward better management of the pollutants and residual wastes spewed out by the economy and the consumer.

25045 **APTIC NO. 45545**

Perdon, Henri

INFORMATION, DOCUMENTATION AND EDUCATION FOR AIR POLLUTION PREVENTION. *(Information, documentation, formation pour la prevention de la pollution atmospherique). Text in French. Pollut. Atmos. (Paris), vol. 13:57-59, May 1972.*

Efforts by competent institutions in France in the fields of air pollution prevention-oriented information, documentation, and education are reviewed. Public, technical, and especially particularized information, offered mainly by such institutions as the Documentation Center of the Institut Francais des Combustibles et de l Engergie and the Centre Interprofessionel Technique d Etudes de la Pollution Atmospherique (CITEPA), as well as the organization of and the participation in pollution control-related exhibitions and conferences, are of major importance. Cooperation with institutions concerned with problems of air pollution prevention in France and abroad, particularly in Great Britain, Poland, and the U.S.A. has been established. Education in matters of combustion-generated pollution prevention covers users of domestic and industrial heating equipment alike. Vocational training courses or organized by CITEPA for hygienists and inspectors.

25046 **APTIC NO. 45870**

Wyman, F. Paul

MEASUREMENT OF CONFLICT BETWEEN ENVIRONMENTAL AND TECHNOLOGICAL VALUES. *Preprint, Inst. of Management Sciences, Providence, R. I., 41p., 1972. 15 refs. (Presented at the Institute of Management Sciences, International Meeting, 19th, Houston, Tex., April 4-8, 1972.)*

Since material progress tends to be valued highly, it is not surprising that most environmental protection activity has been oriented against pollution rather than towards possibly deeper causes, such as values indirectly yet ultimately responsible for pollution. Thus it may be useful to accurately identify a person s viewpoint on such issues using objective measurements. A long-range goal of such a project is to understand what factors dispose persons to various viewpoints, and what types of educational methods are appropriate to increase individual sensitivity and concern for environmental quality. The more immediate goals of the current study interest were development of a scale to measure awareness of the interdependence of environmental quality and technological development as well as the relative importance of environmental and technological values to an individual, and study of the effect of a workshop to induce awareness of value conflicts and change in perceived importance of environmental and technological values. Definitions include and a theoretical framework for values are discussed and basic theoretical models of attitude change are presented. A questionnaire was designed with four components: Environmental-Technology (E-T) Orientation; Awareness of E-T Conflict; Aesthetic Orientation; and Importance of National Goals. The first section contains 10 items of the E-T scale and 10 items of the Aesthetic scale. The second and third sections represent the Awareness and National Goals scales, respectively. Design of the questionnaire is described. Six different hypotheses are presented to account for various types of results with two groups of subjects on the four scales. Data were statistically analyzed indicating that the E-T and Awareness scales have moderate internal and retest reliabilities. Significant correlation was found for Awareness with E-T scale, E scores, and T scores. Subjective evidence suggests that participants perceived no change in their own attitudes but did express increased concern over the topic. It would be highly desirable to conduct a more systematic research of conference and classroom methodology.

1971

25047 **APTIC NO. 45569**

Rubenstein, Franklin David

A BEHAVIORAL STUDY OF POLLUTION: THE ROLE OF PERCEIVED INSTRUMENTALITY IN AN EXTERNALITY SITUATION. *Stanford Univ., Calif., Dept. of Ecology, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., March 1971, 169p. 65 refs.*

Instead of assuming that decision making units will automatically base their decisions on private costs, ignoring social costs, some of the factors and conditions that affect the behavior of persons when faced with conditions of externalities are examined from a behavioral science approach. A laboratory procedure was central to the development of hypotheses in which subjects were confronted with repeated decisions among alternative acts whose consequences increase, hold constant, or decrease the quality of a resource vital to the ability of all players to score well in the game. The degrading of the resource, which is most profitable for the individual, is a social cost borne by all players of the game. The most important implication of the research is that polluting behavior is situationally dependent, that man is not destined by his nature to pollute, even when it may be in his own selfish interest to do so. The development of social norms and programs where people can fight pollution with a sense of accomplishment, rather than frustration, may provide the most viable solutions to the problems of environmental pollution.

GENERAL

1972

25048 **APTIC NO. 46068**

ANTI-POLLUTION SEMINAR STRESSES NEED FOR AVOIDING COMPLACENCY. *Pesticides (Bombay), 6(3):26-28, March 1972.*

Several topics presented at an anti-pollution seminar in India, are summarized. So far no systematic and comprehensive field surveys have been undertaken in India or even in any of its cities; however, there is increasing evidence that fairly widespread damage is being caused to the environment in the country, for example, the washing ashore of dead fish on coastal and river areas caused by low B.O.D., an increase in the number of deaths by food poisoning as a consequence of consuming large doses of insecticides and pesticides through foods, increasing numbers of cases where water in certain rivers and reservoirs are being declared unpotable, and the presence of pollutants such as carbon monoxide, sulfur dioxide, nitrogen oxides, oxidants, and suspended dust in the atmosphere at objectionable levels in cities. There has been an increase in concentrations of carbon dioxide, nitrogen dioxide, nitric oxide, total oxidants, and ammonia in the Bhabha Atomic Research Center area and northern Bombay area. General methodological schemes for air pollution control planning are outlined. Health effects of SO2, NOx, benzo(3-4)pyrene from auto exhausts, CO, and lead are briefly reviewed. Legal and administrative aspects of the pollution problem in India are also discussed.

SUBJECT INDEX

A

ABATEMENT
24539, 24579, 24582, 24729, 24789, 24804, 24848, 24988, 24990, 24991, 24982, 24983, 24998, 24999, 25001, 25002, 25003, 25008, 25012, 25013, 25015, 25020, 25022, 25023, 25026, 25041, 25030, 25031, 25032, 25033, 25035, 25043, 25045, 25047

ABSENTEEISM
24919

ABSORPTION
24599, 24607, 24626, 24627, 24637, 24639, 24729, 24661, 24667, 24694, 24696, 24704, 24708, 24770, 24784, 24828, 24832, 24868, 24882, 24892, 24901, 24904, 24943, 24951, 24954, 24956, 24960, 24966

ABSORPTION (GENERAL)
24525, 24601, 24613, 24623, 24637, 24644, 24648, 24658, 24669, 24680, 24683, 24686, 24693, 24703, 24705, 24832, 24981, 24987

ACETALDEHYDE
24880, 24959

ACETIC ACID
24785, 24858

ACETONE
24767, 24853, 24917

ACETYLENES
24883, 24996

ACROLEIN
24675, 24864

ACUTE
24937

ADSORPTION
24629, 24639, 24729, 24650, 24666, 24684, 24702, 24739, 24714, 24772, 24854, 24863, 24868, 24870, 24872, 24893, 24997

ADSORPTION (GENERAL)
24525, 24722, 24624, 24644, 24705, 24887, 24981

ADVECTION
24849

ADVISORY SERVICES
24789, 25019

AERODYNAMICS
24585, 24759, 24852, 24830, 24884, 24902

AEROSOL GENERATORS
24605, 24853, 24884

AEROSOLS
24590, 24627, 24633, 24689, 24712, 24754, 24759, 24763, 24764, 24773, 24851, 24825, 24828, 24910, 24879, 24913, 24895, 24896, 24897, 24917, 24921, 24940

AFRICA
24836

AFTERBURNERS
24529, 24534, 24544, 24546, 24571, 24578, 24608, 24620, 24629, 24636, 24729, 24683, 24690, 24712, 24714, 24772 25041

AIR CONDITIONING EQUIPMENT
24526, 24689, 25034

AIR POLLUTION EPISODES
24789, 24814, 24815, 25003, 25041, 25030

AIR POLLUTION FORECASTING
24569, 24582, 24583, 24789, 24810, 24849, 24830, 24998, 25009, 25015, 25017

AIR QUALITY CRITERIA
24994, 24995, 24998, 25015

AIR QUALITY MEASUREMENT PROGRAMS
24590, 24723, 24778, 24795, 24841, 24804, 24806, 24819, 24969, 24972, 24959, 25004, 25005, 25006, 25007, 25016, 25027, 25028

AIR QUALITY STANDARDS
24569, 24724, 24629, 24639, 24786, 24848, 24922, 24936, 24993, 24994, 24995, 24998, 24999, 25002, 25012, 25015, 25020, 25041, 25036

AIR RESOURCE MANAGEMENT
24568, 24721, 24750, 24778, 25001, 25002, 25003, 25004, 25005, 25015, 25038, 25021, 25031, 25042, 25035, 25044

AIR-FUEL RATIO
24552, 24603, 24610, 24625, 24728, 24671, 24692, 24907, 24874, 24898

AIRCRAFT
24569, 24802, 24806, 24828, 25034

AIRPORTS
24569

ALABAMA
24919

ALCOHOLS
24532, 24579, 24678, 24712, 24767, 24973

ALDEHYDES
24645, 24675, 24712, 24784, 24864, 24880, 249

ALERTS
24789, 25003, 25030

ALFALFA
24792, 24956, 24971, 24972

ALKALINE ADDITIVES
24525, 24597, 24616, 24723, 24623, 24644, 24658, 24686, 24693, 24703, 24705, 24867, 24981, 24987

ALKALIZED ALUMINA (ADSORPTION)
24644, 24658, 24705

ALLERGIES
24927

ALUMINUM
24537, 24560, 24562, 24968, 24969, 24979, 24983

ALUMINUM COMPOUNDS
24652, 24691, 24739, 24790, 24927, 24930, 24931

ALUMINUM OXIDES
24650, 24738, 24893

ALUMINUM SILICATES
24739, 24790

ALVEOLI
24945, 24930, 24947

AMIDES
24767

AMINES
24556, 24599, 24907, 25025, 25036

AMINO ACIDS
24953

AMMONIA
24532, 24538, 24562, 24607, 24639, 24645, 24694, 24702, 24794, 24841, 24907, 24893, 24914, 24973, 24976, 24987, 25025, 25036, 25048

AMMONIUM COMPOUNDS
24532, 24538, 24562 24607, 24725, 24639, 24645, 24694, 24701, 24702, 24790, 24792, 24794, 24841, 24907, 24893, 24914, 24972, 24973, 24976, 24987, 25025, 25036, 25048

ANEMOMETERS
24885

ANIMALS
24711, 24916, 24917, 24945, 24918, 24921, 24925, 24928, 24947, 24948, 24932, 24949, 24939, 24943, 24968, 24957, 24958, 24993

ANTHRACENES
24762, 24912

ANTICYCLONES
24824

ANTIGENS
24939

AREA EMISSION ALLOCATIONS
25041

AREA SURVEYS
24778, 24806, 24819, 24969, 24972

AROMATIC HYDROCARBONS
24557, 24739, 24769, 24864, 24912, 24901, 24905, 24917, 24996

ARSENIC COMPOUNDS
24725, 24949

ASBESTOS
24774, 24915, 24933

ASBESTOSIS
24933

ASHES
24532, 24536, 24623, 24678, 24691, 24778, 24978, 24984

ASIA
24523, 24553, 24556, 24558, 24568, 24587, 24602, 24607, 24617, 24618, 24631, 24633, 24634, 24638, 24639, 24640, 24641, 24643, 24644, 24645, 24648, 24649, 24651, 24653, 24654, 24662, 24667, 24669, 24671, 24672, 24675, 24676, 24677, 24685, 24686, 24687, 24688, 24696, 24699, 24700, 24702, 24706, 24708, 24709, 24711, 24716, 24718, 24719, 24720, 24742, 24746, 24786, 24761, 24763, 24764, 24770, 24784, 24785, 24797, 24804, 24810, 24811, 24814, 24815, 24816, 24830, 24854, 24863, 24876, 24878, 24879, 24880, 24895, 24896, 24921, 24928, 24932, 24934, 24936, 24938, 24943, 24950, 24993, 24994, 24999, 25001, 25002, 25003, 25040, 25025, 25027, 25036, 25048

ASPHALT
24615, 24798

ASTHMA
24946, 24934

ATMOSPHERIC MOVEMENTS
24674, 24793, 24799, 24800, 24843, 24846, 24806, 24847, 24808, 24810, 24811, 24813, 24814, 24815, 24816, 24849, 24850, 24819, 24820, 24821, 24822, 24852, 24824, 24827, 24830, 24833, 24836, 24839, 24840, 24871, 24940, 24972

ATMOSPHERIC PHENOMENA
24524, 24590, 24538, 24550, 24551, 24555, 24566, 24569, 24582, 24583, 24585, 24609, 24633, 24638, 24730, 24670, 24674, 24696, 24739, 24740, 24720, 24758, 24789, 24792, 24793, 24796, 24841, 24841, 24799, 24799, 24800, 24842, 24842, 24801, 24801, 24802, 24802, 24843, 24845, 24845, 24846, 24846, 24803, 24803, 24804, 24805, 24805, 24806, 24806, 24847, 24848, 24807, 24808, 24809, 24810, 24811, 24812, 24812, 24813, 24814, 24815, 24816, 24849, 24850, 24850, 24817, 24818, 24851, 24819, 24819, 24820, 24821, 24822, 24823, 24852, 24852, 24824, 24825, 24826, 24827, 24828, 24829, 24829, 24853, 24830, 24831, 24832, 24832, 24833, 24834, 24835, 24836, 24837, 24838, 24839, 24840, 24840, 24908, 24871, 24871, 24876, 24911, 24911, 24884, 24891, 24896, 24897, 24899, 24902, 24924, 24936, 24940, 24941, 24968, 24972, 24959, 24961, 24974, 24977, 24979, 24998, 25004, 25005, 25006, 25007, 25009, 25015, 25016, 25017, 25020, 25027, 25042

ATTACK RATES
24915

AUSTRALIA
24795, 24946

AUTOMATIC METHODS
24653, 24681, 24713, 24742, 24745, 24751, 24773, 24776, 24840, 25016, 25028

AUTOMOBILES
24547, 24570, 24571, 24575, 24582, 24586, 24587, 24621, 24848, 24940, 25033

AUTOMOTIVE EMISSION CONTROL
24528, 24529, 24535, 24537, 24547, 24551, 24552, 24567, 24569, 24570, 24571, 24573, 24578, 24586, 24603, 24610, 24625, 24630, 24636, 24728, 24656, 24734, 24671, 24676, 24685, 24690, 24692, 24696, 24848, 24907, 24874, 24898, 24940

AUTOMOTIVE EMISSIONS
24528, 24529, 24530, 24590, 24535, 24547, 24568, 24569, 24570, 24571, 24573, 24578, 24582, 24583, 24586, 24603, 24625, 24630, 24636, 24647, 24656, 24661, 24734, 24676, 24679, 24685, 24690, 24696, 24756, 24804, 24825, 24828, 24834, 24864, 24940, 24959, 24962, 24999, 25001, 25002, 25003, 25008, 25041

B

BACTERIA
24791

BAFFLES
24639

BAG FILTERS
24608, 24727, 24731, 24736, 24672, 24697, 24704, 24707, 24713

BALLOONS
24806

BARIUM COMPOUNDS
24691, 24867

BELGIUM
24546, 24729, 24976

BENZENE-SOLUBLE ORGANIC MATTER
24595

BENZENES
24739, 24769, 24912, 24901, 24905

BENZO(3-4)PYRENE
24656, 25048

BENZOPYRENES
24656, 25048

BERYLLIOSIS
24939

BERYLLIUM COMPOUNDS
24597, 24939

BESSEMER CONVERTERS
24720

BETA PARTICLES
24752, 24832

BIOCLIMATOLOGY
24914

BIRDS
24949

BIRMINGHAM,ALABAMA
24919

BLACK LIQUOR OXIDATION
24524, 24602, 24622, 24631, 24662, 24684, 24693, 24715

BLAST FURNACES
24562, 24727, 24649, 24730

BLOOD CHEMISTRY
24679, 24917

BLOOD PRESSURE
24920

BLOOD VESSELS
24920

BODY FLUIDS
24557, 24679

BOILERS
24525, 24531, 24543, 24591, 24553, 24558, 24565, 24602, 24611, 24615, 24723, 24624, 24648, 24653, 24665, 24671, 24680, 24681, 24684, 24686, 24691, 24693, 24705, 24707, 24710, 24771, 24778

BONES
24679, 24949

BORON COMPOUNDS
24704

BREATHING
24943

BRICKS
24523, 24778

BROMINE COMPOUNDS
24746, 24892

BRONCHI
24924

BRONCHITIS
24946, 24929, 25003

BUDGETS
24630, 25018

BUILD-UP RATES
24585

BUILDINGS
24628, 24787, 24792, 24805, 24819, 24852, 24972

BUSES
24530, 24570

BUTADIENES
24883

BY-PRODUCT RECOVERY
24532, 24565, 24572, 24597, 24722, 24600, 24601, 24607, 24609, 24613, 24725, 24624, 24626, 24642, 24649, 24658, 24732, 24660, 24665, 24667, 24669, 24675, 24678, 24680, 24686, 24693, 24698, 24699, 24701, 24704, 24705, 24721, 24909, 25020

C

CADMIUM COMPOUNDS
24800, 24926, 24927, 24947, 24937, 24949

CALCIUM COMPOUNDS
24725, 24651, 24686, 24738, 24704, 24790, 24841, 24867

CALCIUM SULFATES
24790

CALIBRATION METHODS
24741, 24748, 24753, 24787, 24769, 24773, 24860, 24958

CALIFORNIA
24530, 24575, 24844, 24848, 24822, 24836, 24934

CAMERAS
24821

CANADA
24531, 24561, 24647, 24740, 24755, 24830, 24836, 24881, 24886, 24893, 24925, 24960

CANCER
24915, 24933, 24942

CANNING
24612

CARBIDES
24686

CARBON BLACK
24543, 24554, 24559, 24562, 24722, 24624, 24638, 24640, 24712, 24910, 24870, 24874

CARBON DIOXIDE
24534, 24550, 24554, 24596, 24635, 24639, 24666, 24672, 24738, 24844, 24804, 24828, 24838, 24858, 24863, 24868, 24886, 24901, 24903, 24928, 24936, 24961, 24966, 25048

CARBON MONOXIDE
24529, 24532, 24533, 24546, 24547, 24548, 24549, 24552, 24554, 24559, 24578, 24596, 24581, 24582, 24603, 24608, 24630, 24635, 24636, 24639, 24650, 24656, 24734, 24664,

24672, 24675, 24679, 24682, 24757, 24787, 24806, 24809, 24834, 24838, 24854, 24907, 24858, 24859, 24863, 24870, 24873, 24889, 24891, 24893, 24901, 24903, 24920, 24922, 24948, 24936, 24937, 24941, 24994, 24995, 24997, 25002, 25003, 25005, 25006, 25027, 25030, 25048

CARBONATES
24616, 24725, 24623, 24790

CARBOXYHEMOGLOBIN
24920, 24922, 24928, 24935, 24936, 24941, 24995, 25030

CARBURETION
24535, 24603, 24625, 24636

CARCINOGENS
24914, 24933

CARDIOVASCULAR DISEASES
25030

CASCADE SAMPLERS
24590, 24780, 24790, 24856

CATALYSIS
24527, 24577, 24615, 24616, 24728, 24650, 24652, 24664, 24670, 24673, 24682, 24690, 24691, 24702, 24739, 24854, 24863, 24867, 24872, 24873, 24887

CATALYSTS
24615, 24616, 24728, 24650, 24652, 24664, 24673, 24690, 24691, 24702, 24739, 24854, 24872, 24873, 24887

CATALYTIC ACTIVITY
24728, 24670, 24690, 24887

CATALYTIC AFTERBURNERS
24529, 24546, 24683, 24690, 24714, 24772, 25041

CATALYTIC OXIDATION
24524, 24594, 24602, 24607, 24622, 24629, 24631, 24635, 24728, 24729, 24644, 24652, 24658, 24662, 24664, 24670, 24684, 24693, 24705, 24714, 24715, 24863, 24873, 24981

CATS
24943

CATTLE
24958

CELL GROWTH
24964

CELL METABOLISM
24967

CELLS
24945, 24925, 24928, 24948, 24970, 24959

CEMENTS
24724, 24738, 24748, 24750, 24778, 24927, 24992, 25041

CENTRIFUGAL SEPARATORS
24525, 24538, 24546, 24600, 24608, 24724, 24639, 24729, 24731, 24733, 24695, 24738

CHEMICAL BONDS
24826, 24907, 24889, 24892

CHEMICAL COMPOSITION
2459[illegible], 24777, 24790, 24792, 24841, 24843, 24894, 24951, 24969, 24960

CHEMICAL METHODS
24590, 24610, 24745, 24751, 24785, 24895, 24905

CHEMICAL PROCESSING
24524, 24589, 24531, 24538, 24540, 24542, 24553, 24556, 24562, 24594, 24579, 24587, 24597, 24602, 24606, 24613, 24725, 24622, 24727, 24631, 24728, 24642, 24643, 24655, 24662, 24663, 24666, 24668, 24675, 24678, 24680, 24684, 24693, 24698, 24704, 24740, 24715, 24793, 24798, 24973, 24982, 24986, 24992, 25008, 25009, 25011, 25024, 25033, 25036, 25043

CHEMISTS
25015

CHICAGO
24575, 24582, 24583, 25002, 25034

CHLORIDES
24641, 24654, 24687, 24960

CHLORINATED HYDROCARBONS
24557, 24585, 24654, 24687, 24831, 24855, 24935

CHLORINE
24544, 24562, 24639, 24667, 24741, 24772, 24889, 24956, 24983

CHLORINE COMPOUNDS
24544, 24612, 24641, 24654, 24667, 24684, 24687, 24741, 24841, 24892, 24960, 24965

CHLOROPLASTS
24953

CHLOROSIS
24963, 24964

CHROMATOGRAPHY
24651, 24744, 24751, 24757, 24762, 24769, 24770, 24784, 24785, 24841, 24831, 24880, 24952, 24996, 25027

CHROMIUM
24546, 24980

CHROMIUM COMPOUNDS
24652, 24927

CHRYSENES
24762

CILIA
24925

CINCINNATI
24575, 24836

CIRCULATORY SYSTEM
24917, 24920, 24923, 24941, 24995

CITIZENS GROUPS
25013, 25035, 25043

CITRUS
24952

CLOUD SEEDING
24853

CLOUDS
24810, 24828, 24908

COAL
24525, 24533, 24536, 24541, 24591, 24593, 24562, 24564, 24576, 24597, 24607, 24611, 24723, 24725, 24658, 24660, 24735, 24672, 24683, 24686, 24695, 24705, 24778, 24906, 24909, 24894, 24946, 24985, 25037, 25041

COAL CHARACTERISTICS
24536, 24660, 24705, 24909, 24894, 25041

COAL PREPARATION
24527, 24532, 24564, 24577, 24616, 24723, 24725, 24644, 24658, 24660, 24695, 24705, 24909, 24981, 24984

COAL TARS
24595

COBALT COMPOUNDS
24615, 24854

COKE
24591, 24592, 24616, 24725, 24651, 24668, 24672, 24683, 24694, 24778, 24798, 24973

COLLECTORS
24525, 24531, 24590, 24538, 24539, 24544, 24546, 24600, 24608, 24614, 24724, 24622, 24727, 24639, 24729, 24731, 24733, 24672, 24695, 24738, 24720, 24884

COLORADO
24593

COLORIMETRY
24590, 24632, 24741, 24751, 24786, 24767, 24777, 24784, 24785, 24841, 24880, 24905, 25027

COLUMN CHROMATOGRAPHY
24762, 24996

COMBUSTION
24543, 24554, 24560, 24602, 24626, 24645, 24654, 24731, 24663, 24674, 24693, 24710, 24711, 24742, 24906, 24857, 24867, 24874, 24894, 24898, 24996

COMBUSTION AIR
24533, 24548, 24554, 24578, 24598, 24600, 24602, 24610, 24653, 24656, 24657, 24663, 24734, 24667, 24671, 24681, 24710, 24907

COMBUSTION GASES
24523, 24589, 24525, 24527, 24534, 24590, 24536, 24591, 24546, 24548, 24549, 24593, 24562, 24563, 24564, 24566, 24568, 24576, 24596, 24581, 24597, 24722, 24599, 24601, 24607, 24608, 24609, 24610, 24611, 24613, 24723, 24619, 24623, 24624, 24626, 24637, 24639, 24641, 24644, 24645, 24648, 24649, 24651, 24653, 24730, 24655, 24731, 24658, 24663, 24736, 24669, 24674, 24678, 24680, 24681, 24684, 24686, 24687, 24688, 24691, 24693, 24696, 24697, 24699, 24701, 24705, 24707, 24709, 24710, 24740, 24712, 24715, 24716, 24720, 24742, 24749, 24753, 24771, 24780, 24804, 24847, 24853, 24835, 24859, 24874, 24898, 24914, 24973, 24978, 24979, 24981, 24987, 24999, 2501[illegible]

COMBUSTION PRODUCTS
24523, 24589, 24525, 24527, 24532, 24534, 24590, 24536, 24543, 24591, 24546, 24548, 24549, 24554, 24593, 24562, 24563, 24564, 24566, 24568, 24576, 24596, 24581, 24597, 24722, 24599, 24601, 24607, 24608, 24609, 24610, 24611, 24613, 24723, 24619, 24623, 24624, 24626, 24637, 24639, 24641, 24644, 24645, 24648, 24649, 24651, 24653, 24730, 24655, 24731, 24658, 24663, 24736, 24669, 24674, 24678, 24680, 24681, 24684, 24686, 24687, 24688, 24691, 24693, 24696, 24697, 24699, 24701, 24704, 24705, 24707, 24709, 24710, 24740, 24712, 24715, 24716, 24720, 24742, 24749, 24753, 24771, 24778, 24780, 24804, 24847, 24853, 24835, 24907, 24857, 24859, 24867, 24874, 24898, 24914, 24932, 24973, 24978, 24979, 24981, 24984, 24987, 24999, 25011, 25041, 25032

COMMERCIAL EQUIPMENT
24630, 24637, 24705

COMMERCIAL FIRMS
24727, 24630, 24673, 24982, 25008, 25014, 25033, 25043

COMPLAINTS
24534, 25043

COMPOSTING
24565

COMPRESSION
24586, 24732, 24685, 24978

COMPUTER PROGRAMS
24570, 24575, 24596, 24808, 24835, 24859, 25038, 25035

COMPUTERS
24774, 24825, 24840, 24922, 25009, 25035

CONDENSATION
24592, 24560, 24667, 24687, 24754, 24908, 24859, 24875, 24913, 24897

CONDENSATION (ATMOSPHERIC)
24538, 24807, 24810, 24851, 24825, 24826, 24828, 24908

CONSTRUCTION MATERIALS
24523, 24546, 24609, 24615, 24724, 24655, 24732, 24738, 24704, 24743, 24748, 24750, 24778, 24798, 24927 24978, 24992, 25041

CONTACT PROCESSING
24680

CONTINUOUS MONITORING
24746, 24751, 24762, 24787, 24772, 24775, 24776, 24841, 24885, 25016, 25027

CONTROL AGENCIES
24789, 25015, 25023, 25042, 25034

CONTROL PROGRAMS
24596, 24582, 24583, 24735, 24678, 24778, 24789, 24848, 24998, 25001, 25002, 25003, 25004, 25008, 25020, 25026, 25030, 25031, 25033, 25048

CONVECTION (ATMOSPHERIC)
24811, 24816, 24827, 24836, 24871

COOLING
24553, 24572, 24574, 24600, 24608, 24609, 24655, 24661, 24681, 24688, 24707, 24756, 24978

COOLING TOWERS
24589, 24555, 24574

COPPER
24545, 24546, 24559, 24699, 24980

COPPER COMPOUNDS
24545, 24613, 24635, 24690, 24691, 24873, 24997

CORE OVENS
24714

CORN
24925, 24927, 24951

CORROSION
24531, 24546, 24566, 24581, 24640, 24899, 24979, 24980

COSTS
24589, 24526, 24527, 24528, 24531, 24534, 24537, 24544, 24547, 24550, 24565, 24567, 24574, 24577, 24578, 24596, 24586, 24598, 24611, 24612, 24613, 24723, 24724, 24620, 24623, 24628, 24629, 24630, 24642, 24729, 24644, 24647, 24658, 24660, 24736, 24675, 24678, 24704, 24712, 24751, 24786, 24781, 24988, 24989, 24990, 24991, 24981, 24982, 24983, 24984, 24985, 24986, 24987, 24998, 25004, 25007, 25008, 25011, 25013, 25014, 25015, 25022, 25024, 25042, 25032, 25043

COTTONS
24927

COUGH
24938

COUNTER CURRENTS
24811

CRANKCASE EMISSIONS
24656

CRANKCASE VENTILATION AIR
24656

CRITERIA
24560, 24595, 24724, 24728, 24645, 24660, 24682, 24760, 24830, 24994, 24995, 24998, 25015, 25027, 25041

CROPS
24792, 24925, 24927, 24951, 24969, 24954, 24970, 24956, 24971, 24972, 24958, 24960, 24964

CRYSTAL STRUCTURE
24870, 24997

CUPOLAS
24608, 24736

CYANATES
24607

CYANIDES
24607, 24645, 24678, 24907

CZECHOSLOVAKIA
24738, 24773

D

DATA ANALYSIS
24808, 24825, 25005, 25021

DATA HANDLING SYSTEMS
24570, 24575, 24586, 24795, 24808, 24825, 24834, 24835, 24840, 24859, 25004, 25005, 25006, 25007, 25038, 25021, 25027, 25028, 25035

DECOMPOSITION
24559, 24667, 24861, 24877, 24886, 24894

DENMARK
24885

DENSITY
24659, 24734, 24902

DEPOSITION
24539, 24774, 24792, 24820, 24832, 24837, 24839, 24884, 24921, 24924, 24930, 24951, 24954, 24972

DESULFURIZATION OF FUELS
24525, 24527, 24532, 24564, 24568, 24577, 24606, 24613, 24615, 24616, 24723, 24725, 24728, 24644, 24651, 24658, 24660, 24673, 24695, 24705, 24909, 24981, 24984

DETERGENT MANUFACTURING
24562

DIAGNOSIS
24946, 24926, 24967

DIESEL ENGINES
24528, 24570, 24579, 24630, 24734, 24692

DIFFRACTION
24633, 24829, 24870

DIFFUSION
24569, 24582, 24583, 24633, 24739, 24758, 24800, 24801, 24843, 24845, 24846, 24803, 24806, 24847, 24848, 24808, 24810, 24812, 24849, 24817, 24819, 24820, 24821, 24822, 24852, 24831, 24832, 24833, 24838, 24840, 24876, 24897, 24902, 24924, 24968, 24977, 24998, 25004, 25005, 25017

DIFFUSION MODELS
24569, 24582, 24583, 24758, 24801, 24845, 24803, 24847, 24848, 24808, 24810, 24812, 24849, 24820, 24822, 24852, 24876, 24924, 24998, 25004, 25005, 25017

DIGESTIVE SYSTEM
24938

DIGITAL METHODS
24840

DIOLEFINS
24883

DISPERSIONS
24542, 24759

DISSIPATION RATES
24585

DISSOCIATION
24861, 24867

DISTILLATE OILS
24710

DOGS
24917, 24943

DOMESTIC HEATING
24526, 24541, 24549, 24551, 24552, 24553, 24572, 24580, 24665, 25000, 25037, 25010, 25041

DROPLETS
24754, 24807, 24908, 24878, 24911

DRY CLEANING
24562, 24579

DRYING
24619, 24711

DUMPS
24565

DUST FALL
24778, 24792, 24837, 24915

DUSTS
24532, 24533, 24534, 24539, 24545, 24560, 24596, 24609, 24614, 24618, 24724, 24619, 24727, 24631, 24632, 24634, 24638, 24730, 24655, 24733, 24735, 24672, 24678, 24737, 24688, 24738, 24700, 24701, 24707, 24713, 24715, 24718, 24719, 24720, 24748, 24772, 24778, 24780, 24788, 24797, 24828, 24914, 24925, 24927, 24930, 24947, 24931, 24959, 24973, 24978, 24979, 24983, 25009, 25048

E

ECONOMIC LOSSES
24955, 24990, 24986, 25024, 25043

EDUCATION
24628, 24804, 25008, 25016, 25045, 25046

ELECTRIC FURNACES
24562, 24604, 24688

ELECTRIC POWER PRODUCTION
24523, 24525, 24531, 24590, 24536, 24550, 24551, 24593, 24561, 24564, 24565, 24568, 24569, 24572, 24574, 24576, 24580, 24584, 24587, 24597, 24606, 24611, 24613, 24723, 24624, 24665, 24680, 24695, 24705, 24716, 24717, 24750, 24771, 24809, 24821, 24824, 24981, 24982, 24984, 24985, 24987, 24992, 25010, 25013, 25017, 25018, 25041, 25044

ELECTRIC PROPULSION
24537, 24567, 24570, 24571, 24580, 24705

ELECTRICAL PROPERTIES
24545, 24617, 24632, 24634, 24646, 24659, 24690, 24706, 24718, 24743, 24764, 24841, 24850, 24825, 24865, 24979, 24997

ELECTRICAL RESISTANCE
24545, 24634

ELECTROCHEMICAL METHODS
24610, 24745, 24751

ELECTROCONDUCTIVITY ANALYZERS
24746, 24751, 24772, 24841, 25016, 25027

ELECTROLYSIS
24560, 24584

ELECTRON MICROSCOPY
24590, 24764, 24774, 24930

ELECTROSTATIC PRECIPITATORS
24525, 24531, 24590, 24544, 24545, 24546, 24560, 24568, 24617, 24724, 24619, 24620, 24627, 24727, 24631, 24632, 24634, 24639, 24729, 24646, 24730, 24659, 24736, 24668, 24684, 24686, 24693, 24699, 24700, 24706, 24707, 24709, 24718, 25037

ELUTRIATION
24658

EMISSION INVENTORIES
25005

EMISSION STANDARDS
24529, 24547, 24570, 24573, 24625, 24629, 24630, 24636, 24728, 24692, 24793, 24847, 24848, 24989, 24992, 24994, 25041

EMISSIVITY
24543

EMPHYSEMA
24593, 24946, 24927

ENFORCEMENT PROCEDURES
25023, 25034

ENGINE DESIGN MODIFICATION
24528, 24529, 24537, 24547, 24567, 24569, 24570, 24571, 24578, 24586, 24630, 24685, 24692

ENGINE OPERATING CYCLES
24569, 24570, 24582, 24583, 24625, 24636, 25041

ENGINE OPERATION MODIFICATION
24529, 24535, 24552, 24569, 24571, 24578, 24603, 24610, 24625, 24630, 24636, 24728, 24656, 24734, 24671, 24676, 24692, 24907, 24874, 24898

ENGINEERS
25015

ENZYMES
24557, 24948

EPIDEMIOLOGY
24915, 24916, 24919, 24942, 25028

EQUIPMENT CRITERIA
24645, 24682, 24760

EQUIPMENT STANDARDS
24692

ESTERS
24675, 24687

ETHNIC FACTORS
24915, 24919

ETHYLENE
24870, 24883, 24932, 24955, 24959, 24977

EUROPE
24527, 24533, 24534, 24535, 24538, 24542, 24543, 24545, 24591, 24546, 24547, 24548, 24592, 24554, 24555, 24557, 24559, 24560, 24561, 24563, 24566, 24571, 24572, 24595, 24581, 24604, 24614, 24615, 24724, 24725, 24619, 24627, 24727, 24635, 24636, 24637, 24729, 24650, 24652, 24730, 24656, 24731, 24658, 24659, 24733, 24663, 24664, 24665, 24666, 24668, 24670, 24674, 24678, 24679, 24681, 24682, 24683, 24684, 24737, 24689, 24692, 24694, 24695, 24738, 24703, 24707, 24739, 24712, 24717, 24741, 24745, 24748, 24754, 24756, 24757, 24758, 24760, 24766, 24769, 24772, 24773, 24783, 24788, 24791, 24793, 24794, 24796, 24798, 24841, 24799, 24800, 24801, 24845, 24846, 24803, 24805, 24806, 24812, 24817, 24819, 24820, 24821, 24823, 24852, 24828, 24829, 24830, 24831, 24833, 24837, 24839, 24840, 24855, 24856, 24857, 24909, 24858, 24865, 24866, 24867, 24868, 24869, 24871, 24872, 24873, 24874, 24882, 24883, 24885, 24912, 24913, 24897, 24898, 24923, 24924, 24927, 24930, 24947, 24931, 24937, 24949, 24939, 24940, 24942, 24959, 24973, 24962, 24965, 24976, 24977, 24979, 24980, 24983, 24984, 24997, 25000, 25037, 25001, 25008, 25009, 25011, 25016, 25039, 25019, 25020, 25022, 25023, 25028, 25041, 25031, 25032, 25033, 25043, 25045

EVAPORATORS
24589, 24602, 24622, 24631, 24662, 24693, 24715

EXCESS AIR
24598, 24656, 24710, 24907

EXHAUST SYSTEMS
24604, 24608, 24655, 24735, 24672, 24737, 24696, 24697, 24700, 24711, 24720, 24772

EXPERIMENTAL EQUIPMENT
24733, 24894, 25014

EXPERIMENTAL METHODS
24633, 24747, 24754, 24764, 24782, 24875, 24886, 24894, 24904

EXPLOSIONS
24717, 24874

EXPOSURE CHAMBERS
24963, 24964

EXPOSURE METHODS
24916, 24917, 24945, 24918, 24925, 24928, 24935, 24943, 24953, 24970, 24963, 24964

EYE IRRITATION
24786, 24864, 24925, 24934, 24938

EYES
24914, 24925

F

FADING
24977

FALLOUT
24831

FANS (BLOWERS)
24604, 24655, 24735, 24697

FARMS
24567, 24580

FEASIBILITY STUDIES
24530, 24567, 24568, 24578, 24586, 24723, 24660, 24698, 24782, 24981, 25021

FEDERAL GOVERNMENTS
24564, 24578, 24992, 24998, 25012, 25022

FEES
25022

FERROALLOYS
24688, 24980

FERTILIZER MANUFACTURING
24538, 25036

FERTILIZING
24954, 24971

FIELD TESTS
24749, 24971, 24972

FILTER FABRICS
24544, 24618, 24724, 24727, 24633, 24639, 24729, 24646, 24672, 24677, 24738, 24756, 24772, 24776

FILTERS
24534, 24544, 24604, 24605, 24608, 24614, 24618, 24724, 24622, 24623, 24726, 24727, 24632, 24633, 24638, 24639, 24729, 24646, 24656, 24731, 24736, 24672, 24677, 24689, 24696, 24697, 24738, 24704, 24707, 24711, 24713, 24716, 24756, 24759, 24772, 24773, 24776, 24782, 24879, 24978, 24983

FINLAND
24965

FIRING METHODS
24533, 24543, 24548, 24552, 24554, 24558, 24576, 24578, 24598, 24600, 24602, 24610, 24649, 24653, 24655, 24656, 24657, 24663, 24734, 24667, 24671, 24681, 24699, 24710, 24907

FLAME AFTERBURNERS
24529, 24683, 24714

FLAME IONIZATION DETECTOR
24757, 24770, 24784, 24841, 25027

FLARES
24602, 24674

FLOWERS
24927

FLUID FLOW
24523, 24535, 24536, 24562, 24726, 24632, 24636, 24653, 24730, 24733, 24670, 24677, 24687, 24738, 24703, 24708, 24714, 24753, 24755, 24756, 24787, 24781, 24799, 24803, 24805, 24852, 24830, 24856, 24866, 24875, 24878, 24879, 24911, 24884, 24885, 24900, 24902, 24924

FLUORANTHENES
24762

FLUORESCENCE
24743, 24862, 24901, 24965

FLUORIDES
24704, 24767, 24862, 24932, 24937, 24968, 24955, 24975, 24994

FLUORINATED HYDROCARBONS
24858, 24932, 24977

FLUORINE COMPOUNDS
24538, 24727, 24704, 24767, 24862, 24932, 24937, 24968, 24969, 24955, 24975, 24994

FLY ASH
24536, 24732, 24678, 24695, 24778, 24910, 24987

FOG
24538, 24807

FOOD AND FEED OPERATIONS
24531, 24556, 24562, 24567, 24579, 24580, 24612, 24714, 24902, 24988, 24989, 24991, 25036

FOODS
24541, 24937, 24949, 24944, 24957, 24958, 25048

FORESTS
24721, 24851, 24968, 24961, 24974

FORMALDEHYDES
24712, 24784, 24864

FRACTIONATION
24790

FRANCE
24538, 24724, 24727, 24731, 24684, 24791, 24846, 24830, 24930, 24937, 24997, 25037, 25009, 25039, 25041, 25045

FREE RADICALS
24867, 24887, 24891, 24903, 24945

FROTH FLOATATION
24658

FRUITS
24940, 24952, 24958, 24962

FUEL ADDITIVES
24588, 24566, 24731, 24679, 24691, 24940, 25041, 25033

FUEL CELLS
24571, 24705

FUEL CHARGING
24734

FUEL CRITERIA
24994, 25041

FUEL EVAPORATION
24625, 24647, 24661

FUEL GASES
24526, 24527, 24532, 24534, 24549, 24553, 24554, 24558, 24559, 24562, 24564, 24598, 24607, 24625, 24629, 24655, 24658, 24665, 24668, 24672, 24674, 24694, 24822, 25010

FUEL OIL PREPARATION
24525, 24577, 24606, 24615, 24723, 24644, 24658, 24981

FUEL OILS
24525, 24533, 24534, 24541, 24549, 24552, 24553, 24554, 24562, 24566, 24577, 24606, 24611, 24615, 24723, 24629, 24644, 24648, 24655, 24658, 24734, 24673, 24691, 24699, 24701, 24710, 24742, 25008, 25010, 25041

FUEL STANDARDS
24679, 24994

FUEL TANK EVAPORATION
24647

FUMES
24596, 24612, 24620, 24629, 24643, 24764, 24978

FUNGI
24791, 24796, 24839, 24970, 24959

FURNACES
24543, 24544, 24545, 24548, 24592, 24554, 24562, 24566, 24595, 24597, 24604, 24608, 24609, 24611, 24723, 24621, 24726, 24624, 24629, 24727, 24648, 24649, 24730, 24654, 24655, 24731, 24657, 24663, 24736, 24672, 24688, 24691, 24699, 24700, 24704, 24705, 24710, 24712, 24715, 24720, 24778, 24983

G

GAMMA RADIATION
24746

GAS CHROMATOGRAPHY
24651, 24751, 24757, 24769, 24770, 24784, 24785, 24841, 24831, 24880, 24952, 24996, 25027

GAS SAMPLING
24751

GAS TURBINES
24528, 24529, 24547, 24569, 24570, 24571, 24578, 24586, 24723

GASIFICATION (SYNTHESIS)
24527, 24532, 24577, 24616, 24723, 24725, 24644, 24658, 24705

GASOLINES
24588, 24529, 24661, 24679, 24864, 24940, 25024, 25033

GENETICS
24975

GERMANY
24533, 24534, 24547, 24548, 24555, 24557, 24566, 24572, 24595, 24604, 24614, 24619, 24627, 24636, 24637, 24650, 24733, 24665, 24683, 24689, 24707, 24712, 24748, 24756, 24757, 24760, 24772, 24788, 24793, 24799, 24856, 24882, 24924, 24927, 24931, 24962, 24979, 24983, 25000, 25011, 25019, 25022, 25031, 25032

GLASS
24704

GLASS FABRICS
24724, 24727, 24672, 24756, 24776

GRAIN PROCESSING
24902

GRANTS
25012

GRAPES
24962

GRAPHITE
24640

GRASSES
24969, 24954

GRAVITY SETTLING
24633, 24801, 24809

GREAT BRITAIN
24527, 24543, 24561, 24571, 24692, 24783, 24800, 24823, 24852, 24830, 24865, 24867, 24871, 24874, 24898, 24949, 24940, 24942, 24977, 25001, 25045

GREENHOUSES
24792, 24972

GROUND LEVEL
24801, 24806, 24847, 24808, 24817, 24820, 24822, 24835, 24871, 24876

GUINEA PIGS
24943

H

HALOGEN GASES
24544, 24562, 24639, 24667, 24739, 24741, 24772, 24889, 24892, 24914, 24956, 24983

HALOGENATED HYDROCARBONS
24557, 24585, 24654, 24687, 24831, 24855, 24858, 24932, 24935, 24977

HAZE
24825

HEADACHE
24938

HEALTH IMPAIRMENT
24646, 24679, 24923, 24925, 24934, 24938, 24940, 25003, 25048

HEALTH STATISTICS
24593, 24915, 24929, 25028

HEARINGS
24593, 25010

HEART
24920, 24923, 24995

HEAT CAPACITY
24676

HEAT OF COMBUSTION
24572, 24665, 24898

HEAT TRANSFER
24551, 24553, 24572, 24574, 24600, 24608, 24609, 24625, 24626, 24629, 24631, 24653, 24655, 24661, 24667, 24681, 24688, 24707, 24756, 24907, 24871, 24875, 24978

HEMATOLOGY
24679, 24917, 24920, 24922, 24928, 24935, 24936, 24938, 24941, 24995, 25030

HEMOGLOBIN INTERACTIONS
24941, 24995

HERBICIDES
25016

HERBS
24954

HI-VOL SAMPLERS
24776, 24778, 24781

HIGHWAYS
24961

HOGS
24925

HORMONES
24557

HOUSTON
24575

HUMIDITY
24555, 24566, 24609, 24730, 24670, 24796, 24806, 24809, 24815, 24816, 24827, 24828, 24884, 24896, 24897, 24899, 24979

HYDRIDES
24858

HYDROCHLORIC ACID
24544, 24596, 24581, 24626, 24641, 24654, 24667, 24793, 24976, 24967

HYDROCYANIC ACID
24607

HYDRODESULFURIZATION
24525, 24577, 24615, 24658

HYDROFLUORIC ACID
24538, 24562, 24862, 24932, 24956, 24959, 24976, 24967

HYDROGEN
24532, 24559, 24573, 24574, 24584, 24807, 24854, 24907, 24910, 24867, 24870

HYDROGEN SULFIDE
24589, 24532, 24563, 24574, 24596, 24607, 24622, 24623, 24642, 24670, 24684, 24786, 24770, 24772, 24937, 24976, 25006, 25009, 25025, 25036

HYDROSPHERE
24832, 24833

HYDROXIDES
24651, 24672, 24838, 24867, 24868, 24891, 24903

HYPOXIA
24920, 24941

I

ILLINOIS
24575, 24582, 24583, 24834, 25002, 25034

IMMUNOLOGY
24939, 24970

IMPINGERS
24793

INCINERATION
24534, 24544, 24546, 24557, 24562, 24565, 24581, 24598, 24600, 24620, 24622, 24628,

24629, 24637, 24641, 24729, 24663, 24667, 24674, 24675, 24680, 24684, 24698, 24711, 24712, 24714, 24750, 24992, 25041

INDOOR
24627, 24639, 24689, 24787, 24772, 24798, 24797, 24936

INDUSTRIAL AREAS
24568, 24790, 24792, 24793, 24798, 24800, 24806, 24821, 24831, 24972, 25030

INDUSTRIAL EMISSION SOURCES
24523, 24524, 24589, 24525, 24531, 24534, 24590, 24536, 24538, 24539, 24540, 24541, 24542, 24544, 24545, 24546, 24548, 24550, 24551, 24553, 24593, 24556, 24557, 24559, 24560, 24561, 24562, 24563, 24564, 24565, 24594, 24567, 24568, 24569, 24572, 24574, 24595, 24576, 24596, 24579, 24580, 24581, 24584, 24587, 24597, 24598, 24600, 24602, 24604, 24606, 24607, 24609, 24611, 24612, 24613, 24723, 24724, 24725, 24619, 24620, 24621, 24622, 24624, 24628, 24629, 24727, 24631, 24637, 24641, 24728, 24642, 24643, 24729, 24647, 24649, 24651, 24655, 24657, 24732, 24661, 24662, 24663, 24665, 24735, 24666, 24667, 24736, 24668, 24672, 24674, 24675, 24678, 24680, 24684, 24693, 24695, 24697, 24698, 24699, 24700, 24702, 24704, 24705, 24707, 24740, 24711, 24712, 24713, 24714, 24715, 24716, 24717, 24721, 24748, 24750, 24771, 24782, 24793, 24798, 24797, 24800, 24809, 24821, 24824, 24902, 24946, 24927, 24947, 24937, 24968, 24969, 24954, 24960, 24973, 24965, 24988, 24989, 24990, 24991, 24981, 24982, 24983, 24984, 24985, 24986, 24987, 24992, 24999, 25037, 25008, 25009, 25010, 25011, 25013, 25017, 25018, 25019, 25024, 25041, 25042, 25033, 25034, 25036, 25043, 25044

INERTIAL SEPARATION
24633, 24879

INFECTIOUS DISEASES
24970

INFLUENZA
24916, 24919

INFRARED RADIATION
24895

INFRARED SPECTROMETRY
24742, 24772, 24782, 24785, 24794, 24880, 24887, 24947, 24997

INHIBITION
24901, 24920, 24948, 24977

INORGANIC ACIDS
24590, 24538, 24544, 24562, 24594, 24566, 24596, 24581, 24609, 24725, 24619, 24626, 24641, 24728, 24642, 24654, 24666, 24667, 24680, 24699, 24738, 24793, 24862, 24891, 24932, 24956, 24959, 24976, 24967, 24992

INSPECTION
25002, 25041

INSTRUMENTATION
24554, 24610, 24655, 24681, 24713, 24741, 24742, 24744, 24747, 24764, 24765, 24779, 24783, 24904, 25006, 25007, 25014, 25016, 25029

INTERNAL COMBUSTION ENGINES
24528, 24535, 24569, 24570, 24571, 24573, 24579, 24586, 24615, 24630, 24636, 24734, 24692, 24834

INVERSION
24846, 24806, 24816, 24849, 24835, 24836

IODIMETRIC METHODS
24785, 24905

IODINE COMPOUNDS
24892

IONIZATION
24760, 24869, 24904

IONIZATION CHAMBERS
24865

IONS
24652, 24702, 24744, 24767, 24865, 24869, 24873, 24893

IRON
24537, 24546, 24548, 24562, 24595, 24596, 24604, 24621, 24629, 24649, 24651, 24736, 24700, 24702, 24707, 24947, 24980, 25019

IRON COMPOUNDS
24545, 24909, 24927, 24930, 24931

IRON OXIDES
24609, 24651, 24738

IRRADIATION CHAMBERS
24864, 24877

ISOTOPES
24635, 24746, 24807, 24832, 24834, 24872

ITALY
24543, 24745, 24857, 25008, 25016

J

JAPAN
24523, 24553, 24556, 24558, 24587, 24602, 24607, 24617, 24618, 24631, 24633, 24634, 24638, 24639, 24640, 24641, 24643, 24644, 24645, 24648, 24649, 24651, 24653, 24654, 24662, 24667, 24669, 24671, 24672, 24675, 24676, 24677, 24685, 24686, 24687, 24688, 24696, 24699, 24700, 24702, 24706, 24708, 24709, 24711, 24716, 24718, 24719, 24720, 24742, 24746, 24761, 24763, 24764, 24770, 24784, 24785, 24797, 24810, 24811, 24814, 24815, 24816, 24830, 24863, 24876, 24878, 24879, 24880, 24895, 24896, 24921, 24928, 24932, 24934 24936, 24938, 24943, 24950, 24993, 24994, 24999, 25001, 25002, 25003, 25040, 25025, 25027, 25036

JET AIRCRAFT
24828

K

KETONES
24767, 24853, 24917

KIDNEYS
24557, 24926

KILNS
24565, 24602, 24724, 24651, 24655, 24657, 24732, 24927, 24954, 24960

KRAFT PULPING
24524, 24589, 24540, 24562, 24602, 24622, 24727, 24631, 24655, 24662, 24684, 24693, 24698, 24715, 24986, 25009

L

LABORATORY ANIMALS
24916, 24917, 24945, 24918, 24921, 24928, 24947, 24948, 24932, 24939, 24943

LABORATORY FACILITIES
24563, 24884, 25047

LACQUERS
24712

LAKES
24944

LAND USE
24568, 24961, 24966, 25017

LANDFILLS
24565

LAPSE CONDITION
24806, 24817, 24836, 24871

LASERS
24717, 24765, 24783, 24829, 24862, 24910, 24885

LATIN AMERICA
24929, 24961

LAUNDERING (COAL)
24660

LEAD
24537, 24562, 24899

LEAD ALLOYS
24899

LEAD COMPOUNDS
24603, 24679, 24691, 24704, 24759, 24764, 24800, 24864, 24921, 24926, 24947, 24937, 24949, 24940, 24951, 24954, 24958, 24960, 24962, 24994, 25003, 25024, 25033, 25048

LEAVES
24950, 24951, 24953, 24969, 24970, 24959, 24963, 24964, 24965

LEGISLATION
24990, 25001, 25008, 25013, 25015, 25039, 25022, 25041, 25032, 25034

LETTUCE
24960, 24963

LIDAR
24749

LIGHT SCATTERING
24760, 24763, 24765, 24818, 24825, 24910, 24882, 25027

LIME
24602, 24724, 24651, 24655, 24732, 24927, 24954, 24960

LIMESTONE
24778, 24987

LINE SOURCES
24808, 24822

LIQUIDS
24549, 24563, 24574, 24585, 24600, 24725, 24634, 24637, 24641, 24734, 24688, 24738, 24708, 24765, 24769, 24807, 24832, 24856, 24860, 24866, 24891, 24893, 24897, 24900, 24945, 24977

LITHIUM COMPOUNDS
24597, 24853

LITIGATION
25012

LIVER
24938

LOCAL GOVERNMENTS
25037, 25034

LONDON
25001

LOS ANGELES
24575, 24844, 24848, 24822, 24934

LOWER ATMOSPHERE
24803, 24850, 24851, 24819, 24852, 24827, 24829, 24833, 24838

LUBRICANTS
24638, 24706

LUNG CANCER
24915, 24933, 24942

LUNGS
24916, 24945, 24918, 24921, 24923, 24924, 24928, 24930, 24947, 24948, 24931, 24933, 24939, 24943

M

MAGNESIUM
24537

MAGNESIUM COMPOUNDS
24637, 24691, 24790, 24841, 24873, 24887, 24930, 24987

MAGNETIC PROPERTIES
24610, 24652, 24751, 24850, 24997

MAGNETOHYDRODYNAMICS (MHD)
24576, 24705

MAINTENANCE
24611, 24614, 24622, 24628, 24736, 24692, 24738, 24983

MANGANESE
24980

MANGANESE COMPOUNDS
24690, 24691

MANGANESE DIOXIDE (JAPANESE)
24644, 24658

MAPPING
24847, 25006

MASS SPECTROMETRY
24834, 24859, 24996

MASS TRANSPORTATION
25002

MATHEMATICAL ANALYSES
24551, 24555, 24561, 24587, 24633, 24659, 24663, 24677, 24682, 24737, 24753, 24763, 24764, 24842, 24801, 24802, 24844, 24807, 24813, 24850, 24818, 24851, 24852, 24826, 24827, 24830, 24835, 24838, 24907, 24856, 24857, 24861, 24865, 24866, 24910, 24868, 24879, 24893, 24913, 24895, 24900, 24902, 24922, 24966, 24977, 24981, 24984, 25005, 25009, 25042

MATHEMATICAL MODELING
24551, 24561, 24682, 24842, 24802, 24844, 24807, 24813, 24850, 24851, 24826, 24827, 24830, 24907, 24861, 24879, 24922, 25005, 25042

MAXIMUM ALLOWABLE CONCENTRATION
24724, 24639, 24786, 24922, 24936, 24995, 25020, 25041

MEETINGS
24804, 25016

MEMBRANE FILTERS
24595, 24627, 24774, 24782

MEMBRANES
24914, 24945, 24918, 24927, 24928, 24947

MERCAPTANS
24524, 24589, 24684, 24770, 25025, 25036

MERCURY COMPOUNDS
24536, 24541, 24542, 24591, 24612, 24906, 24855, 24909, 24894, 24937, 24949, 24944, 24957

METABOLISM
24948, 24951, 24964

METAL COMPOUNDS
24527, 24536, 24541, 24542, 24545, 24591, 24595, 24597, 24601, 24603, 24605, 24612, 24613, 24615, 24725, 24635, 24637, 24641, 24651, 24652, 24664, 24669, 24673, 24679, 24737, 24686, 24687, 24690, 24691, 24699, 24738, 24701, 24703, 24704, 24739, 24746, 24759, 24764, 24778, 24790, 24793, 24797, 24841, 24800, 24853, 24906, 24854, 24855, 24909, 24864, 24867, 24868, 24872, 24873, 24875, 24887, 24894, 24895, 24897, 24921, 24926, 24927, 24930, 24947, 24931, 24937, 24949, 24939, 24940, 24944, 24951, 24954, 24971, 24957, 24958, 24960, 24962, 24976, 24987, 24994, 24997, 25003, 25016, 25024, 25033, 25048

METAL FABRICATING AND FINISHING
24545, 24562, 24579, 24629, 24736, 24672, 24697, 24699, 24713, 24982

METAL POISONING
2454 , 24940, 24944

METALS
24537, 24545, 24546, 24548, 24550, 24559, 24560, 24562, 24595, 24596, 24604, 24621, 24629, 24649, 24650, 24651, 24736, 24670, 24688, 24699, 24700, 24702, 24707, 24863, 24910, 24870, 24892, 24899, 24947, 24968, 24969, 24979, 24980, 24983, 25019

METEOROLOGICAL INSTRUMENTS
24841, 24806, 24885

METEOROLOGY
24538, 24550, 24551, 24555, 24566, 24585, 24609, 24730, 24670, 24674, 24792, 24793, 24796, 24841, 24799, 24800, 24842, 24802, 24843, 24846, 24804, 24806, 24847, 24807, 24808, 24809, 24810, 24811, 24813, 24814, 24815, 24816, 24849, 24850, 24851, 24819, 24820, 24821, 24822, 24823, 24852, 24824, 24825, 24826, 24827, 24828, 24853, 24830, 24831, 24833, 24834, 24836, 24837, 24839, 24840, 24908, 24871, 24884, 24891, 24896, 24897, 24899, 24936, 24940, 24972, 24961, 24979, 25004, 25005, 25006, 25007, 25016, 25017, 25027, 25042

METHANES
24527, 24546, 24559, 24574, 24577, 24757, 24838, 24907, 24855, 24858, 24898, 24935, 25006

MICE
24916, 24918, 24928, 24947, 24948

MICHIGAN
25035

MICROMETEOROLOGY
24811, 24813, 24819, 24836, 25006

MICROORGANISMS
24557, 24754, 24791, 24796, 24839, 24916, 24970, 24956, 24959, 24974

MICROSCOPY
24590, 24778

MIDDLE ATMOSPHERE
24833, 24838, 24891

MINERAL PROCESSING
24539, 24562, 24563, 24609, 24724, 24619, 24735, 24748, 24750, 24782, 24798, 24946, 24992, 25037, 25041

MINING
24539, 24609, 24735, 24946, 25037

MISSILES AND ROCKETS
24768

MISSOURI
24853, 25006, 25007

MISTS
24596, 24683

MOLYBDENUM
24546

MOLYBDENUM COMPOUNDS
24545, 24615

MONITORING
24525, 24612, 24681, 24713, 24745, 24746, 24750, 24751, 24753, 24757, 24762, 24787, 24768, 24771, 24772, 24775, 24776, 24778, 24790, 24792, 24841, 24885, 25006, 25008, 25016, 25027

MONTANA
24968

MONTHLY
24843, 24831, 24950

MORTALITY
24593, 24915, 24933, 24942, 24974

MOTTLING
24950

MOUNTAINS
24593, 24790, 24968

MULTIPLE CHAMBER INCINERATORS
24534, 24544

N

NAPHTHALENES
24579, 24912

NAPHTHENES
24527

NASHVILLE
24600

NATIONAL AIR SAMPLING NETWORK (NASN)
24590

NATURAL GAS
24526, 24527, 24532, 24549, 24554, 24558, 24559, 24562, 24564, 24598, 24625, 24629, 24665, 24674, 24822, 25010

NECROSIS
24538, 24950, 24955, 24959, 24963, 24964

NERVOUS SYSTEM
24920, 24925, 24949, 24995

NETHERLANDS
24554, 24561, 24581, 24674, 24828, 24839, 24923, 24959, 25043

NEUTRON ACTIVATION ANALYSIS
24746

NEW YORK CITY
24575, 24779, 24849, 24836

NEW YORK STATE
24575, 24779, 24849, 24836

NICKEL
24537, 24546, 24699, 24980

NICKEL COMPOUNDS
24673

NITRATES
24785, 24790, 24792, 24864, 24880, 24888, 24891, 24896, 24955, 24956, 24972, 24975, 24976, 24967

NITRIC ACID
24594, 24728, 24666, 24891, 24992

NITRIC ANHYDRIDE (N2O5)
24880

NITRIC OXIDE (NO)
24636, 24657, 24685, 24747, 24765, 24772, 24779, 24783, 24784, 24785, 24791, 24809, 24828, 24907, 24860, 24869, 24880, 24883, 24888, 24891, 24896, 24898, 24904, 24905, 24959, 24997, 25006, 25048

NITRILES
24977

NITROGEN
24574, 24672, 24678, 24702, 24710, 24739, 24765, 24792, 24861, 24910, 24889, 24890, 24901, 24971, 24972, 24960

NITROGEN DIOXIDE (NO2)
24657, 24666, 24747, 24772, 24784, 24785, 24791, 24809, 24907, 24864, 24880, 24883, 24888, 24891, 24895, 24896, 24899, 24905, 24928, 24934, 24950, 24955, 24959, 24975, 25048

NITROGEN OXIDES
24525, 24529, 24533, 24549, 24552, 24553, 24593, 24594, 24568, 24576, 24578, 24596, 24582, 24587, 24603, 24723, 24630, 24636, 24728, 24653, 24656, 24657, 24734, 24666, 24671, 24676, 24685, 24704, 24710, 24747, 24750, 24751, 24765, 24772, 24779, 24783, 24784, 24785, 24791, 24792, 24841, 24844, 24848, 24809, 24828, 24907, 24860, 24861, 24864, 24869, 24880, 24881, 24883, 24888, 24890, 24891, 24895, 24896, 24898, 24899, 24904, 24905, 24914, 24928, 24934, 24937, 24950, 24955, 24956, 24972, 24959, 24975, 24976, 24993, 24994, 24997, 24999, 25002, 25003, 25005, 25006, 25048

NITROGEN TRIOXIDE (NO3)
24841, 24972

NITROUS OXIDE (N2O)
24861, 24881, 24890

NON-INDUSTRIAL EMISSION SOURCES
24589, 24526, 24531, 24534, 24590, 24541, 24544, 24549, 24551, 24552, 24553, 24563, 24565, 24568, 24572, 24580, 24581, 24598, 24600, 24725, 24621, 24626, 24637, 24641, 24654, 24655, 24663, 24665, 24667, 24674, 24678, 24696, 24697, 24711, 24768, 24834, 24937, 24949, 24954, 24971, 24961, 25000, 25037, 25008, 25010, 25011, 25029, 25041, 25032, 25036, 25044, 25048

NON-URBAN AREAS
24567, 24580, 24689, 24788, 24790, 24792, 24819, 24929, 24972, 25004, 25006, 25027

NORTH CAROLINA
24919

NOSTRILS
24918, 24925

NUCLEAR EXPLOSIONS
24717

NUCLEAR POWER PLANTS
24550, 24564, 24568, 24584, 24716, 24717, 24985, 25013

NUCLEATION
24826, 24857, 24859, 24897, 24959

NUCLEIC ACIDS
24953

O

OATS
24956, 24960

OCEANS
24541, 24844, 24851, 24832, 24833, 24944

OCTANES
24529, 25033

ODOR COUNTERACTION
24556, 24602, 24620, 24631, 24729, 24662, 24684, 24696, 24708, 24711, 24714, 24715, 25025

ODORIMETRY
24556, 24758, 24761, 24766, 24770

ODORS
24524, 24589, 24534, 24544, 24556, 24565, 24579, 24602, 24620, 24629, 24727, 24631, 24662, 24696, 24708, 24711, 24715, 24758, 24761, 24770, 25025, 25036

OHIO
24575, 24836

OIL BURNERS
24554, 24562, 24611, 24648, 24655, 24691, 24710

OIL RESOURCES
24606, 24644

OLEFINS
24675, 24870, 24883, 24912, 24896, 24932, 24955, 24959, 24977, 24996

OPEN BURNING
24961

OPEN HEARTH FURNACES
24548, 24562, 24621, 24730, 24672

OPERATING CRITERIA
24560, 24724, 24728, 24660

OPERATING VARIABLES
24524, 24589, 24532, 24535, 24542, 24548, 24552, 24554, 24555, 24563, 24567, 24570, 24575, 24577, 24578, 24586, 24587, 24722, 24599, 24601, 24602, 24608, 24609, 24610, 24616, 24617, 24723, 24724, 24620, 24622, 24726, 24625, 24727, 24632, 24641, 24728, 24642, 24646, 24648, 24730, 24655, 24656, 24657, 24658, 24660, 24661, 24663, 24734, 24736, 24669, 24673, 24675, 24676, 24679, 24680, 24685, 24691, 24692, 24693, 24695, 24699, 24700, 24704, 24705, 24710, 24714, 24715, 24743, 24786, 24755, 24760, 24774, 24781, 24841, 24978, 24981

ORGANIC ACIDS
24607, 24759, 24785, 24858, 24896, 24952

ORGANIC DISEASES
24926

ORGANIC NITROGEN COMPOUNDS
24556, 24579, 24599, 24627, 24663, 24767, 24792, 24907, 24860, 24972, 25025, 25036

ORGANIC SULFUR COMPOUNDS
24524, 24589, 24579, 24622, 24684, 24693, 24770, 24855, 25009, 25025, 25036

ORGANIC WASTES
24663, 24667, 24711

ORGANOMETALLICS
24767, 24855, 24996

OSAKA
24607, 24810

OXIDANT PRECURSORS
24864

OXIDANTS
24785, 24844, 24814, 24815, 24864, 24896, 24905, 24934, 24950, 24974, 24975, 24993, 25002, 25005, 25048

OXIDATION
24613, 24652, 24675, 24685, 24714, 24838, 24907, 24860, 24895, 24952, 24997

OXYGEN
24610, 24664, 24672, 24681, 24747, 24772, 24860, 24861, 24863, 24870, 24872, 24886, 24889, 24890, 24895, 24896, 24903, 24905, 24948, 24936, 24941, 24961, 24977

OXYGEN CONSUMPTION
24995

OZONE
24684, 24708, 24747, 24779, 24785, 24809, 24828, 24833, 24864, 24880, 24912, 24886, 24890, 24891, 24895, 24896, 24905, 24945, 24923, 24934, 24943, 24953, 24970, 24955, 24956, 24959, 24974, 24963, 24975, 24964, 24966, 24976, 24967, 25006

P

PACKED TOWERS
24641, 24669, 24683, 24987

PAINT MANUFACTURING
24562, 24714

PAINTS
24557, 24629

PAPER MANUFACTURING
24531, 24562, 24631, 24637, 24655, 24662, 24698, 24721, 24965, 24990, 24982, 24986, 25009

PARIS
25041

PARTICLE COUNTERS
24632, 24764

PARTICLE GROWTH
24646, 24688, 24826, 24853, 24908, 24857, 24865, 24875, 24878, 24913, 24897

PARTICLE SHAPE
24807, 24825, 24837, 24902

PARTICLE SIZE
24545, 24592, 24614, 24726, 24632, 24633, 24646, 24730, 24733, 24672, 24682, 24689, 24738, 24752, 24754, 24756, 24759, 24763, 24764, 24774, 24809, 24823, 24825, 24837, 24857, 24909, 24865, 24875, 24882, 24884, 24885, 24913, 24921, 24924, 24936, 24940, 24978

PARTICULATE SAMPLING
24752, 24756, 24776, 24780, 24875

PATHOLOGICAL TECHNIQUES
24918, 24946, 24925, 24926, 24928, 24930

PENNSYLVANIA
24778, 24915, 25010

PENTANES
24858, 24881

PERMEABILITY
24774, 24775, 24879, 24977

PERMITS
24992, 25013, 25022

PEROXIDES
24785, 24945

PEROXYACETYL NITRATE
24785, 24864, 24880, 24888, 24896, 24955, 24975, 24967

PEROXYACYL NITRATES
24785, 24864, 24880, 24888, 24896, 24955, 24956, 24975, 24976, 24967

PERSONNEL
24531, 24628, 24787, 24988, 25004, 25007, 25008, 25015, 25021

PERSONNEL QUALIFICATIONS
25007, 25014

PERYLENES
24762, 24798

PESTICIDES
24557, 24585, 24844, 24831, 24877, 25016, 25048

PETER SPENCE PROCESS (CLAUS)
24623, 24680

PETROLEUM DISTRIBUTION
24647, 24661

PETROLEUM REFINING
24562, 24579, 24587, 24606, 24613, 24642, 24740, 24798, 24982, 25008, 25011, 25024, 25033, 25036, 25043

PH
24767, 24832, 24960

PHENOLS
24532, 24579, 24678, 24712, 24973

PHENYL COMPOUNDS
24557

PHILADELPHIA
24915

PHOSPHORESCENCE
24901

PHOSPHORIC ACID
24538, 24562

PHOSPHORUS COMPOUNDS
24757, 24960

PHOTOCHEMICAL REACTIONS
24590, 24779, 24844, 24804, 24848, 24811, 24814, 24815, 24816, 24825, 24828, 24838, 24858, 24864, 24872, 24877, 24880, 24886, 24888, 24890, 24891, 24895, 24896, 24905, 24934, 24938, 24950, 24959, 25002, 25003, 25005

PHOTOELECTRIC PHENOMENA
24747, 24765, 24862, 24869

PHOTOGRAPHIC METHODS
24778, 24803, 24821

PHOTOIONIZATION
24869, 24904

PHOTOLYSIS
24838, 24858, 24886, 24890, 24891

PHOTOMETRIC METHODS
24741, 24748, 24749, 24751, 24763, 24770, 24771, 24773, 24780, 24785, 24841, 24825, 24910, 24885, 25027

PHOTOOXIDATION
24888, 24895, 24896

PHOTOSYNTHESIS
24844, 24966

PHYTOTOXICANTS
25016

PILOT PLANTS
24613, 24623, 24698

PINTO BEANS
24953

PLANNING AND ZONING
24568, 24582, 24583, 24768, 24961, 24966, 24976, 25037, 25003, 25004, 25006, 25017, 25020, 25041, 25030, 25031

PLANT DAMAGE
24538, 24950, 24968, 24955, 24956, 24959, 24973, 24974, 24963, 24964, 24976, 24967

PLANT GROWTH
24792, 24844, 24950, 24951, 24953, 24954, 24971, 24959, 24960, 24973, 24974, 24964, 24966, 24967

PLANT INDICATORS
24800, 24955, 24959, 24976

PLASTICS
24544, 24581, 24626, 24643, 24645, 24654, 24675, 24775, 24859, 24932

PLATINUM
24650, 24863, 24870, 24892

PLUME BEHAVIOR
24758, 24801, 24846, 24803, 24807, 24808, 24809, 24821, 24835, 24876

PNEUMOCONIOSIS
24539, 24782, 24946, 24930, 24931, 24933

PNEUMONIA
24916

POINT SOURCES
24524, 24801, 24845, 24846, 24803, 24808, 24820, 24822, 24998, 25017

POLAROGRAPHIC METHODS
24745, 24751

POLLENS
24796

POLLUTION PRECURSORS
24864

POLYMERIZATION
24540

POLYNUCLEAR COMPOUNDS
24595, 24579, 24656, 24756, 24762, 24798, 24912, 25048

POTASSIUM COMPOUNDS
24601, 24790, 24793, 24841, 24868, 24971

POTENTIOMETRIC METHODS
24745

POULTRY
24711

POWER CYCLES
24723

POWER SOURCES
24525, 24528, 24529, 24530, 24535, 24537, 24547, 24551, 24567, 24569, 24570, 24571, 24573, 24574, 24578, 24579, 24580, 24584, 24586, 24615, 24723, 24630, 24636, 24734, 24692, 24705, 24717, 24834

PRECIPITATION
24792, 24796, 24841, 24843, 24846, 24804, 24807, 24813, 24851, 24823, 24827, 24853, 24831, 24837, 24839, 24908, 24891, 24972

PRESSURE (ATMOSPHERIC)
24842, 24810, 24811, 24813, 24814, 24833

PRIMARY METALLURGICAL PROCESSING
24548, 24559, 24560, 24562, 24595, 24596, 24597, 24604, 24609, 24621, 24727, 24649, 24700, 24702, 24707, 24797, 24800, 24947, 24968, 24969, 24982, 24983, 25037, 25011 25019, 25041

PROCESS MODIFICATION
24589, 24525, 24533, 24534, 24543, 24548, 24592, 24552, 24554, 24558, 24559, 24565, 24594, 24576, 24578, 24596, 24597, 24598, 24600, 24602, 24610, 24611, 24723, 24622, 24629, 24728, 24642, 24649, 24653, 24655, 24656, 24657, 24663, 24734, 24667, 24671, 24675, 24678, 24681, 24693, 24697, 24699, 24702, 24705, 24710, 24712, 24714, 24715, 24717, 24719, 24798, 24907

PROPANES
24554, 24625, 24675, 24867

PROPENES
24675, 24896

PROPOSALS
24741, 25010, 25026, 25029

PROTECTIVE MASKS
24595

PROTEINS
24939, 24953

PUBLIC AFFAIRS
24534, 24579, 24735, 25013, 25040, 25035, 25043, 25044, 25045

PUBLIC INFORMATION
24735, 25040, 25045

PULMONARY FUNCTION
24786, 24946, 24923, 24924, 24943

PULMONARY RESISTANCE
24943

PULVERIZED FUELS
24686

PYRENES
24656, 24762, 25048

PYROLYSIS
24559, 24599, 24859

Q

QUARTZ
24733, 24778, 24782, 24790, 24927

QUENCHING
24901

QUESTIONNAIRES
25046

R

RABBITS
24945, 24943

RADIATION MEASURING SYSTEMS
24554, 24752, 24832

RADIOACTIVE RADIATION
24716, 24743, 24746, 24752, 24807, 24853, 24831, 24832

RADIOACTIVE TRACERS
24832

RADIOGRAPHY
24915, 24946, 24938

RAIN
24843, 24807, 24827, 24853, 24908, 24891

RAPPING
24614, 24727

RATS
24921, 24932, 24939

REACTION KINETICS
24542, 24624, 24664, 24690, 24703, 24739, 24747, 24834, 24854, 24907, 24857, 24858, 24860, 24862, 24863, 24866, 24867, 24870, 24872, 24881, 24883, 24912, 24886, 24888, 24891, 24896, 24899, 24901, 24903, 24997

REACTION MECHANISMS
24540, 24554, 24624, 24635, 24650, 24664, 24690, 24691, 24747, 24907, 24857, 24859,

24863, 24866, 24867, 24872, 24880, 24883, 24912, 24886, 24887, 24888, 24891, 24895, 24896, 24898, 24899, 24901, 24903, 24945, 24996, 24997, 25005

REACTORS (NUCLEAR)
24568, 24716

RECOMBINATION
24865

RECORDING METHODS
24778, 24803, 24821, 24832, 24840

REDUCTION
24594, 24722, 24613, 24623, 24652, 24894, 24997

REFRACTIVE INDEX
24763, 24825, 24829, 24860, 24882

REFRACTORIES
24910

REGIONAL GOVERNMENTS
25000, 25004, 25005, 25006, 25007

REGULATIONS
24539, 24564, 24639, 24660, 24750, 24940, 24989, 24990, 24991, 24985, 24998, 24999, 25000, 25013, 25039, 25025, 25041, 25030, 25035, 25036

RENDERING
24579, 24714

REPRODUCTION
24974

RESEARCH INSTITUTES
25016

RESEARCH METHODOLOGIES
24605, 24675, 24676, 24755, 24768, 24802, 24830, 24981, 25004, 25005, 25006, 25007, 25038, 25045, 25047, 25046

RESEARCH PROGRAMS
24528, 24530, 24595, 24576, 24578, 24625, 24673, 24768, 24967, 25004, 25005, 25008, 25009, 25014, 25018, 25019, 25026, 25028, 25034

RESIDENTIAL AREAS
24628, 24790, 24972, 25030

RESIDUAL OILS
24606, 24615, 24644, 24648, 24673, 24710

RESPIRATORY DISEASES
24539, 24593, 24782, 24916, 24918, 24946, 24919, 24927, 24929, 24930, 24931, 24933, 24934, 24938, 25003, 25020

RESPIRATORY SYSTEM
24786, 24774, 24914, 24916, 24945, 24918, 24921, 24923, 24924, 24925, 24927, 24928, 24930, 24947, 24948, 24931, 24933, 24939, 24943

RETENTION
24539, 24792, 24931, 24949, 24941, 24944, 24951, 24968, 24954, 24971, 24972, 24960, 24962

RINGELMANN CHART
24780

RIVERS
24944

RUBBER
24562, 24645

RUBBER MANUFACTURING
24562

S

SAFETY EQUIPMENT
24595, 24655, 24697

SALTZMAN METHOD
24784, 24785

SAMPLERS
24590, 24595, 24627, 24751, 24756, 24769, 24774, 24776, 24778, 24780, 24781, 24782, 24790, 24791, 24793, 24856, 24875, 25027

SAMPLING PROBES
24554, 24751, 24752, 24996

SAN FRANCISCO
24836

SCANDINAVIA
24679, 24758, 24766, 24831, 24885, 24965

SCATTERING (ATMOSPHERIC)
24851, 24825, 24828, 24829, 24871

SCRUBBERS
24531, 24538, 24539, 24544, 24546, 24568, 24581, 24597, 24599, 24600, 24601, 24602, 24607, 24608, 24609, 24612, 24623, 24627, 24628, 24727, 24631, 24637, 24639, 24640, 24641, 24643, 24729, 24646, 24654, 24655, 24731, 24658, 24735, 24667, 24736, 24669, 24680, 24681, 24683, 24684, 24686, 24688, 24699, 24738, 24700, 24704, 24705, 24707, 24711, 24713, 24714, 24719, 24772, 24793, 24987

SEA BREEZE
24815

SEA SALTS
24979

SEALING COMPOUNDS
24979

SEALS
24979

SECONDARY AIR
24554, 24598

SEDIMENTATION
24633, 24646, 24678, 24754, 24801, 24809, 24839, 24879, 24897

SENATE HEARINGS
24593

SETTLING CHAMBERS
24884

SETTLING PARTICLES
24532, 24533, 24534, 24590, 24539, 24543, 24545, 24554, 24560, 24566, 24568, 24596, 24581, 24609, 24614, 24618, 24724, 24619, 24727, 24631, 24632, 24634, 24638, 24645, 24730, 24655, 24733, 24735, 24672, 24678, 24737, 24688, 24691, 24738, 24700, 24701, 24707, 24713, 24715, 24718, 24719, 24720, 24748, 24772, 24778, 24780, 24788, 24797, 24828, 24867, 24874, 24878, 24882, 24900, 24914, 24925, 24927, 24930, 24947, 24931, 24940, 24959, 24973, 24978, 24979, 24983, 24996, 25009, 25048

SEWAGE
24544, 24565, 24725, 24655, 24696

SEWAGE TREATMENT
24565, 24696

SHIPS
24526

SILICATES
24790

SILICON COMPOUNDS
24545, 24672, 24790, 24930, 24980

SILICON DIOXIDE
24651, 24666, 24672, 24738, 24704, 24782, 24931

SILICOSIS
24539, 24782, 24931

SILVER COMPOUNDS
24595

SIMULATION
24570, 24582, 24710, 24830, 24876, 24902, 24966, 25004, 25038, 25035

SINGLE CHAMBER INCINERATORS
24544

SINTERING
24562, 24738, 24700, 24778

SKIN
24914

SLUDGE
24544, 24725, 24655

SMOG
24689, 24779, 24804, 24848, 24811, 24814, 24815, 24816, 24896, 24905, 24934, 24938, 24950, 25001, 25003

SMOKE SHADE
24549, 24748, 24780, 24882

SMOKEMETERS
24748, 24749, 24760, 24780, 24882

SMOKES
24534, 24549, 24552, 24610, 24611, 24620, 24630, 24648, 24692, 24748, 24749, 24846, 24876, 24882, 25001, 25008, 25041

SMOKING
24627, 24639, 24915, 24929, 24936, 24942, 25030

SNOW
24813, 24823, 24837

SOAP MANUFACTURING
24562

SOCIAL ATTITUDES
25044, 25047, 25046

SOCIO-ECONOMIC FACTORS
24531, 24561, 24567, 24568, 24579, 24580, 24919, 24961, 24988, 24989, 24990, 24991, 25004, 25005, 25012, 25038, 25039, 25021, 25024, 25042, 25033, 25043

SODIUM CARBONATE
24703

SODIUM CHLORIDE
24605

SODIUM COMPOUNDS
24542, 24597, 24605, 24725, 24641, 24669, 24687, 24699, 24703, 24704, 24739, 24790, 24841, 24868

SODIUM HYDROXIDE
24542, 24641, 24687, 24868

SODIUM SULFITE
24699, 24703

SOILS
24541, 24585, 24950, 24951, 24954, 24956, 24971, 24972, 24960

SOLAR RADIATION
24717, 24841, 24847, 24848, 24809, 24810, 24816, 24828, 24833, 24895

SOLID WASTE DISPOSAL
24534, 24544, 24565, 24581, 24598, 24600, 24725, 24621, 24626, 24641, 24654, 24663, 24667, 24674, 24678, 24697, 24711, 25011, 25029, 25032, 25044

SOLIDS
24560, 24873

SOLVENT REFINING (LOW ASH)
24660, 24705

SOLVENTS
24579, 24599, 24615, 24629, 24712, 24767

SOOT
24534, 24543, 24554, 24566, 24568, 24581, 24645, 24678, 24691, 24867, 24874, 24882, 24979, 24996

SOURCE SAMPLING
24595, 24750, 24751, 24753, 24755, 24775

SOUTH AMERICA
24929, 24961

SOYBEANS
24964

SO2 REMOVAL (COMBUSTION PRODUCTS)
24525, 24597, 24722, 24601, 24606, 24609, 24613, 24616, 24723, 24623, 24624, 24631, 24637, 24644, 24648, 24652, 24653, 24658, 24669, 24680, 24683, 24686, 24687, 24693, 24703, 24705, 24832, 24867, 24887, 24981, 24987

SPARK IGNITION ENGINES
24570

SPECTROMETRY
24652, 24742, 24744, 24751, 24762, 24767, 24772, 24782, 24785, 24794, 24832, 24834, 24859, 24869, 24872, 24873, 24880, 24887, 24892, 24947, 24996, 24997

SPECTROPHOTOMETRY
24590, 24762, 24765, 24783, 24784, 24785, 24790, 24841, 24800, 24906, 24860, 24894, 24901, 24921, 24957, 24958, 24962

SPORES
24839

SPOT TESTS
24786

SPRAY TOWERS
24608, 24609, 24667, 24688, 24700

SPRAYS
24878, 24900

ST LOUIS
24853, 25006, 25007

STABILITY (ATMOSPHERIC)
24799, 24842, 24802, 24845, 24846, 24804, 24806, 24847, 24808, 24816, 24849, 24817, 24819, 24822, 24852, 24833, 24835, 24836, 24871

STACK GASES
24523, 24589, 24525, 24527, 24536, 24546, 24548, 24593, 24562, 24563, 24568, 24596, 24597, 24722, 24599, 24609, 24613, 24723, 24619, 24623, 24624, 24641, 24644, 24648, 24649, 24730, 24736, 24669, 24674, 24678, 24680, 24681, 24684, 24686, 24687, 24688, 24691, 24693, 24696, 24697, 24699, 24705, 24707, 24740, 24715, 24716, 24720, 24749, 24753, 24771, 24780, 24847, 24853, 24835, 24874, 24973, 24978, 24981, 24987, 25011

STACK SAMPLING
24595, 24751, 24753, 24775

STACKS
24523, 24525, 24562, 24568, 24729, 24653, 24705, 24740, 24753, 24846, 24847, 24807, 24876, 25041

STATE GOVERNMENTS
25010, 25012, 25022

STATISTICAL ANALYSES
24585, 24663, 24801, 24815, 25046

STEAM
24527, 24531, 24574, 24577, 24600, 24616, 24674, 24675

STEAM ENGINES
24530, 24570, 24571

STEAM PLANTS
24531, 24536, 24550, 24565, 24576, 24723, 24624, 24680, 24750, 24771, 24985, 25013, 25017

STEEL
24546, 24548, 24562, 24595, 24596, 24604, 24621, 24629, 24649, 24702, 24707, 24947, 24980, 25019

STORAGE BATTERIES
24537, 24567, 24570, 24571

STREETS
24962, 25002

STRONTIUM COMPOUNDS
24867

SULFATES
24545, 24601, 24669, 24701, 24704, 24767, 24790, 24792, 24841, 24887, 24895, 24915, 24971, 24972

SULFIDES
24524, 24589, 24527, 24532, 24540, 24556, 24563, 24574, 24596, 24607, 24622, 24623, 24642, 24670, 24684, 24786, 24770, 24772, 24778, 24937, 24976, 25006, 25009, 25025, 25036

SULFITES
24597, 24601, 24637, 24767, 24887

SULFUR COMPOUNDS
24524, 24589, 24527, 24532, 24540, 24545, 24592, 24556, 24563, 24564, 24566, 24574, 24596, 24597, 24601, 24607, 24613, 24725, 24622, 24623, 24637, 24642, 24669, 24670, 24684, 24693, 24701, 24704, 24715, 24786, 24757, 24767, 24770, 24772, 24777, 24778, 24790, 24792, 24841, 24804, 24887, 24895, 24915, 24937, 24971, 24972, 24960, 24973, 24965, 24976, 25006, 25009, 25025, 25041, 25036

SULFUR DIOXIDE
24589, 24533, 24590, 24538, 24552, 24553, 24593, 24596, 24727, 24641, 24651, 24652, 24653, 24670, 24684, 24691, 24693, 24699, 24715, 24742, 24745, 24751, 24775, 24791, 24792, 24806, 24809, 24849, 24821, 24832, 24887, 24892, 24895, 24896, 24901, 24914, 24915, 24916, 24918, 24925, 24934, 24936, 24943, 24950, 24952, 24955, 24956, 24972, 24959, 24975, 24976, 24967, 24980, 24999, 25001, 25006, 25009, 25011, 25017, 25032, 25048

SULFUR OXIDES
24589, 24533, 24590, 24538, 24549, 24552, 24553, 24593, 24564, 24566, 24568, 24576, 24596, 24722, 24601, 24613, 24727, 24641, 24651, 24652, 24653, 24670, 24684, 24691, 24693, 24699, 24704, 24715, 24742, 24745, 24750, 24751, 24775, 24791, 24792, 24806, 24809, 24810, 24849, 24821, 24832, 24855, 24887, 24892, 24895, 24896, 24901, 24914, 24915, 24916, 24918, 24925, 24934, 24936, 24943, 24950, 24952, 24955, 24956, 24972, 24959, 24975, 24976, 24967, 24980, 24994, 24999, 25001, 25002, 25005, 25006, 25009, 25011, 25017, 25027, 25032, 25048

SULFUR OXIDES CONTROL
24525, 24527, 24532, 24564, 24568, 24577, 24597, 24722, 24601, 24606, 24609, 24613, 24615, 24616, 24723, 24725, 24623, 24624, 24631, 24637, 24728, 24644, 24648, 24651, 24652, 24653, 24658, 24660, 24669, 24673, 24680, 24683, 24686, 24687, 24693, 24695, 24703, 24705, 24832, 24909, 24867, 24887, 24981, 24984, 24987, 25003

SULFUR TRIOXIDE
24722, 24601, 24613, 24691, 24791, 24855, 24887, 24895

SULFURIC ACID
24590, 24562, 24566, 24596, 24609, 24725, 24619, 24642, 24667, 24680, 24699, 24738, 24992

SUPERSATURATION
24897

SURFACE COATING OPERATIONS
24562, 24579, 24629, 24712, 24714

SURFACE COATINGS
24557, 24629, 24712, 24978, 24979

SURFACE PROPERTIES
24635, 24650, 24651, 24670, 24685, 24702, 24854, 24857, 24863, 24870, 24873, 24884, 24893, 24945, 24947

SURFACTANTS
24887, 24893

SURVEY METHODS
24723, 24841, 25004, 25005, 25006, 25007, 25028

SUSPENDED PARTICULATES
24534, 24590, 24536, 24549, 24552, 24596, 24601, 24610, 24611, 24612, 24620, 24629, 24630, 24639, 24643, 24648, 24732, 24678, 24683, 24689, 24692, 24695, 24748, 24749, 24754, 24764, 24778, 24779, 24796, 24846, 24804, 24848, 24807, 24811, 24814, 24815, 24816, 24908, 24910, 24876, 24878, 24911, 24882, 24885, 24896, 24905, 24934, 24936, 24938, 24940, 24950, 24978, 24987, 24994, 25001, 25003, 25006, 25008, 25041

SWEDEN
24679, 24758, 24766, 24831

SYNERGISM
24914, 24918, 24925, 24928, 24936, 24942, 24967

SYNTHETIC FIBERS
24562

SYNTHETIC RUBBER
24562, 24645

T

TAR
24532, 24544, 24591, 24560, 24725, 24668, 24874

TAXATION
25011, 25042

TECHNICAL SOCIETIES
25028, 25045

TEFLON
24932

TEMPERATURE
24529, 24532, 24534, 24542, 24546, 24559, 24560, 24562, 24563, 24566, 24574, 24577, 24597, 24600, 24608, 24615, 24616, 24624, 24640, 24728, 24645, 24651, 24652, 24730, 24734, 24664, 24666, 24670, 24672, 24682, 24690, 24738, 24702, 24712, 24714, 24751, 24753, 24755, 24756, 24775, 24854, 24907, 24858, 24861, 24863, 24910, 24870, 24872, 24873, 24875, 24883, 24887, 24889, 24893, 24945, 24932, 24978

TEMPERATURE (ATMOSPHERIC)
24551, 24555, 24585, 24796, 24846, 24804, 24806, 24809, 24811, 24815, 24816, 24850, 24851, 24824, 24828, 24836, 24896

TEMPERATURE GRADIENT
24817, 24819, 24836

TENNESSEE
24600

TENSILE STRENGTH
24546

TETRAETHYL LEAD
24864, 24940, 25033

TEXAS
24575, 24790

TEXTILE MANUFACTURING
24531, 24562, 24620, 25037

TEXTILES
24562, 24927, 24977

THERMAL RADIATION
24525, 24572, 24584, 24625, 24631, 24646, 24675, 24851, 24824, 24828, 24910, 24978

THERMODYNAMICS
24529, 24551, 24554, 24555, 24577, 24676, 24807, 24849, 24851, 24854, 24863, 24900

THIOPHENE
24684

THRESHOLDS
24539, 24556, 24595, 24579, 24787, 24766, 24770, 24914, 24926, 24935, 24940, 24995

TIN
24899

TIN COMPOUNDS
24897

TIP BURN
24950

TIRES
24546, 24641

TISSUES
24557, 24918, 24927, 24948, 24959

TITANIUM COMPOUNDS
24931

TOKYO
24556, 24587, 24814, 24815, 24816, 24950, 25003

TOLUENES
24769, 24917

TOPOGRAPHIC INTERACTIONS
24843, 24805, 24819, 24852, 24836, 24876, 24974, 25006, 25027

TOXIC TOLERANCES
24679, 24918, 24970, 24956, 24973, 24974, 24963, 24975, 24964, 24976, 24967, 25030

TOXICITY
24539, 24541, 24557, 24786, 24761, 24914, 24916, 24917, 24918, 24925, 24928, 24932, 24933, 24934, 24935, 24936, 24937, 24949, 24940, 24943, 24959, 24963, 24975, 24993, 25030, 25048

TRACE ANALYSIS
24743, 24772

TRACERS
24853

TRACHEA
24918

TRADE ASSOCIATIONS
25009, 25045

TRANSMISSOMETERS
24749

TRANSPORT
24590, 24800, 24842, 24807, 24818, 24831, 24833, 24834, 24837, 24838, 24839, 24911, 24941, 25004

TREES
24698, 24721, 24950, 24968, 24969, 24955, 24956, 24959, 24973, 24974, 24965, 24967

TRUCKS
24528, 24547, 24570, 24582, 24787

TUBERCULOSIS
24931

TUMORS
24933

TURBIDIMETRY
24841, 24815

TURBULENCE (ATMOSPHERIC)
24841, 24799, 24842, 24801, 24802, 24845, 24846, 24803, 24805, 24806, 24812, 24850, 24819, 24852, 24829, 24832, 24840, 24871, 24911

TVA
24809

U

ULTRASONICS
24646

ULTRAVIOLET RADIATION
24877, 24886, 24904

ULTRAVIOLET SPECTROMETRY
24762, 24785, 24872

UNITED STATES
24561, 24595, 24636, 24717, 24795, 24830, 24995, 25011, 25040, 25023, 25026, 25045

UNIVERSITIES
25045

UPPER ATMOSPHERE
24814, 24833, 24838

URANIUM COMPOUNDS
24797

URBAN AREAS
24590, 24549, 24553, 24556, 24568, 24571, 24575, 24582, 24583, 24600, 24628, 24689, 24768, 24788, 24790, 24791, 24792, 24793, 24798, 24799, 24800, 24805, 24806, 24848, 24808, 24814, 24816, 24849, 24851, 24819, 24821, 24822, 24852, 24824, 24853, 24831, 24836, 24896, 24915, 24919, 24929, 24949, 24942, 24950, 24955, 24972, 24965, 24994, 25001, 25002, 25003, 25004, 25006, 25007, 25016, 25027, 25041, 25030, 25034, 25035, 25048

USSR
24535, 24542, 24545, 24591, 24559, 24560, 24561, 24563, 24615, 24725, 24635, 24652, 24730, 24656, 24663, 24664, 24666, 24668, 24670, 24681, 24682, 24737, 24695, 24703, 24739, 24717, 24741, 24754, 24769, 24794, 24796, 24798, 24801, 24803, 24805, 24806, 24812, 24817, 24819, 24820, 24829, 24830, 24833, 24837, 24840, 24855, 24909, 24858, 24866, 24868, 24869, 24872, 24873, 24883, 24912, 24913, 24897, 24939, 24973, 24980, 25020, 25023, 25028

V

VALLEYS
24593

VANADIUM COMPOUNDS
24664, 24673, 24701

VAPOR PRESSURE
24703, 24863

VAPOR RECOVERY SYSTEMS
24647, 24661

VAPORS
24527, 24531, 24536, 24542, 24549, 24574, 24577, 24600, 24616, 24674, 24675, 24683, 24739, 24765, 24772, 24828, 24875, 24877, 24897, 24927, 24977

VEGETABLES
24940, 24950, 24953, 24958, 24960, 24962, 24963

VENTILATION
24604, 24797, 24936

VENTILATION (PULMONARY)
24947, 24943, 24995

VENTURI SCRUBBERS
24544, 24727, 24637, 24640, 24643, 24654, 24683, 24700, 24705, 24707, 24713, 24719, 24772, 24987

VIRUSES
24916

VOLATILITY
24588, 24542, 24592, 24585, 25033

VOLCANOES
24541

VOLTAGE
24617, 24706, 24718, 24764

W

WASHINGTON (STATE)
24549

WASHINGTON D C
24768

WASHOUT
24843, 24807, 24839

WATER
24549, 24563, 24574, 24585, 24600, 24634, 24641, 24734, 24688, 24738, 24765, 24832, 24891, 24893, 24897, 24900, 24977

WATER POLLUTION
24589, 24531, 24563, 24568, 24572, 24637, 24678, 24937, 24949, 25008, 25011, 25029, 25036, 25048

WEATHER FORECASTING
24802, 24813

WEATHER MODIFICATION
24550, 24551, 24804, 24851, 24824, 24828, 24853, 24836, 24936

WETTING
24539, 24735

WHEAT
24970

WIND ROSE
24822

WIND TUNNELS
24805, 24830, 24876, 24911, 24884

WINDS
24674, 24793, 24799, 24800, 24843, 24846, 24806, 24847, 24808, 24810, 24811, 24813, 24815, 24816, 24849, 24850, 24819, 24820, 24821, 24822, 24852, 24824, 24827, 24836, 24839, 24840, 24940

WISCONSIN
24792, 24944, 24971, 24972

WOOD
24562, 24640, 24698, 24721, 24927

WOOLS
24927

X

X-RAYS
24743

XYLENES
24769

Z

ZINC
24562

ZINC COMPOUNDS
24527, 24545, 24800, 24872, 24875, 24947, 24931, 24949

AUTHOR INDEX

A

ADACHI T

CLINICAL OBSERVATIONS OF PHOTOCHEMICAL SMOG INCIDENTS AT TAKASHI JR. HIGH SCHOOL AND OTHER PLACES.
24938 APTIC NO. 46351

ADAM J R

INTERACTIONS BETWEEN EQUAL-SIZED DROPLETS DUE TO THE WAKE EFFECT.
24908 APTIC NO. 45621

ADAM R

DIVERSE OPINIONS IN THE U. S.: IN THE COMBAT AGAINST WATER POLLUTION AND AIR POLLUTION.
*25011 APTIC NO. 45722

ADAMS F W

FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS.
24969 APTIC NO. 45663

AHRENS D

THE DEPENDENCE OF WIND PROFILES ON THE WEATHER CONDITION.
*24799 APTIC NO. 46354

AIGENSON A S

METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
*24615 APTIC NO. 45425

AKIMOV V S

METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

ALARY J

STUDYING FLUORINE EMISSIONS FROM PHOSPHORIC ACID AND FERTILIZER MANUFACTURING SOURCES.
24538 APTIC NO. 46119

ALDRIDGE C L

DESULFURIZATION OF FLUID PETROLEUM COKE.
*24616 APTIC NO. 45454

ALENGRIN F

STUDYING FLUORINE EMISSIONS FROM PHOSPHORIC ACID AND FERTILIZER MANUFACTURING SOURCES.
24538 APTIC NO. 46119

ALEXANDER R M

AIR POLLUTION AND THE NEW FEDERALISM.
*25012 APTIC NO. 46095

ALLEN E R

THE CHEMISTRY OF AEROSOLS.
*24590 APTIC NO. 45534

ALLEN H P

ENVIRONMENT AND ENERGY--WHERE ARE WE, AND WHERE ARE WE GOING? Edison Elec. Inst. Bull., 40(2):84-89, March-April 1972. (Presented at the Los Angeles Breakfast Club, Los Angeles, Calif., Dec. 15, 1971.)
25013 APTIC NO. 45437

EMISSION CONTROL AT THE KRAFT RECOVERY FURNACE.
24715 APTIC NO. 45763

ANDO Y

ELECTROSTATIC PRECIPITATOR.
*24617 APTIC NO. 45398

ANDREWS R L

INFLUENCE OF COMBUSTION MODIFICATION AND FUEL NITROGEN CONTENT ON NITROGEN OXIDES EMISSIONS FROM FUEL OIL COMBUSTION.
24710 APTIC NO. 46265

ANDREYEV V I

THE FUEL LAYER OCCURRING IN THE CARBURETOR INLET PIPE.
*24535 APTIC NO. 45418

ANDROSHCHUK L A

HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES.
24563 APTIC NO. 46308

ANTROPOV B V

SULFUR DIOXIDE ABSORPTION KINETICS IN ALKALINE SOLUTIONS UNDER FOAMING CONDITIONS.
24703 APTIC NO. 45643

ANUFRIYENKO V F

EPR STUDY OF THE CONDITION OF COPPER INVOLVED IN THE COPPER-MAGNESIUM OXIDATION CATALYST.
24873 APTIC NO. 45371

ARAI K

AIR CLEANING DEVICE.
*24618 APTIC NO. 45424

ARCHER D H

EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
*24723 APTIC NO. 45475

ARITO H

THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS. (NO. 3).
24932 APTIC NO. 45683

ARMIN H

SAMPLING AND ANALYTICS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AUTOMOBILE EXHAUST GAS. I. OPTIMIZATION OF THE COLLECTING ARRANGEMENT - ENRICHMENT OF THE POLYCYCLIC AROMATIC HYDROCARBONS.
24756 APTIC NO. 46365

ARSEN YAN T I

THE USE OF DIFFRACTION ANTENNAS IN THE VISUAL RANGE TO STUDY PROPAGATION OF LASER RADIATION IN THE ATMOSPERHE.
24829 APTIC NO. 45457

ASAKINO K

APPLICATION OF RADIOACTIVATED ANALYSIS TO AIR POLLUTION.
*24746 APTIC NO. 45401

ASHIHARA Y

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

AYUZAWA S

DUST COLLECTION FOR METAL SILICON MANUFACTURING.
24672 APTIC NO. 46141

B

BAILEY B W

COLD VAPOR ATOMIC ABSORPTION DETERMINATION OF MERCURY IN COAL.
*24906 APTIC NO. 45588

BALAJI GUPTA R

INTERACTION OF HYDROGEN AND CARBON MONOXIDE ON COBALT CATALYSTS. PART I.
*24854 APTIC NO. 46171

BALL F J

SO2 RECOVERY VIA ACTIVATED CARBON.
24624 APTIC NO. 46153

BAMBECK R J

PRACTICAL APPLICATION OF A FAST RESPONSE CONTINUOUS BOILER FLUE GAS MONITORING SYSTEM.
24771 APTIC NO. 46098

BANERJEE N N

HYDROGEN SULPHIDE - ITS HAZARDS AND A NEW DETECTOR TUBE FOR ITS SPOT ESTIMATION.
24786 APTIC NO. 45361

BANKS O N

THE ROLE OF THE COMMERCIAL ANALYTICAL SERVICE IN SOLVING WIRE INDUSTRY AIR AND WATER POLLUTION PROBLEMS.
*25014 APTIC NO. 45449

BARETTA E D

CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE.
24935 APTIC NO. 45651

BARTOK W

LABORATORY STUDIES AND MATHEMATICAL MODELING OF NOX FORMATION IN COMBUSTION PROCESSES. (FINAL REPORT).
*24907 APTIC NO. 45591

BASOLO F

A NEW MODE OF SULFUR DIOXIDE ATTACHMENT TO HALOGENATED TRANSITION METAL COMPLEXES.
24892 APTIC NO. 45648

BASTRESS E K

ASSESSING THE IMPACT OF AIRCRAFT EMISSIONS UPON AIR QUALITY.
24569 APTIC NO. 45860

BAUDELAIRE J

ACTION IN THE LIME AND CEMENT INDUSTRIES.
*24724 APTIC NO. 45539

BAUMHARDT G R

LEAD UPTAKE AND CORN GROWTH WITH SOIL-APPLIED LEAD.
*24951 APTIC NO. 46072

BEARD J H

THE ENHANCEMENT OF ORANGE OIL OXIDATION BY SULPHUR DIOXIDE.
*24952 APTIC NO. 46087

BEER J M

NOX FORMATION IN COMBUSTION.
24898 APTIC NO. 45754

BELETSKAYA I P

REACTIONS OF SULFUR TRIOXIDE AND DIOXANE SULFOTRIOXIDE WITH ORGANIC MERCURY COMPOUNDS.
*24855 APTIC NO. 45645

BELONOZHKO A M

COKE AND CHEMICAL PRODUCTION WASTES AND WAYS OF USING THEM.
*24725 APTIC NO. 45426

BELTING K W

PROCESSING OF PHOSPHOGYPSUM TO ANHYDRITE FOR THE GYPSUM/SULPHURIC ACID PROCESS.
*24619 APTIC NO. 46366

BELTRAN M R

SMOKE ABATEMENT FOR TEXTILE FINISHERS.
*24620 APTIC NO. 46199

BEN TAARIT Y

ESR AND IR STUDIES ON THE ADSORPTION AND DISPROPORTIONATION OF NITRIC OXIDE ON COPPER EXCHANGED Y ZEOLITES, AND OF REDUCTION BY CARBON MONOXIDE.
24997 APTIC NO. 46064

BENNETT K W

ECOLOGY S LATEST SACRIFICE: BURNED NO. 2 BUNDLES? Iron Age, 210(9):28, Aug. 31, 1972.
24621 APTIC NO. 46169

IS INCINERATION THE ONLY ALTERNATIVE FOR CONTROLLING AIR POLLUTION EMISSIONS FROM THE MANUFACTURE OF STEEL SHIPPING CONTAINERS? Preprint, American Inst. of Chemical Engineers, New York, 30p., 1972. 5 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 72nd, St. Louis, Mo., May 21-24, 1972.)
24629 APTIC NO. 46035

METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

BERG H

DETERMINATION OF LEAD IN VEGETABLE AND FRUIT INCLUDING GRAPES BY ATOMIC ABSORPTION SPECTROPHOTOMETRY.
24962 APTIC NO. 46368

BERGLUND B

MAN AS MEASURING INSTRUMENT.
24766 APTIC NO. 46172

BERGLUND U

MAN AS MEASURING INSTRUMENT.
24766 APTIC NO. 46172

BERKAU E E

A STUDY OF AIR POLLUTANT EMISSIONS FROM OIL-FIRED DOMESTIC HEATING EQUIPMENT.
24552 APTIC NO. 45810

BERNSTEIN L

PLANTS THAT WILL WITHSTAND POLLUTION AND REDUCE IT.
24955 APTIC NO. 45540

BERRY J P

A STUDY OF PULMONARY DUST DEPOSITS USING THE ELECTRON MICROSCOPE IN CONJUNCTION WITH THE ELECTRON SOUND ANALYSER.
24930 APTIC NO. 46150

BETHKE G W

REMOTE MEASUREMENT OF SMOKE PLUME TRANSMITTANCE USING LIDAR.
24749 APTIC NO. 46088

BIELECKA W

EFFECT OF CADMIUM, LEAD AND ZINC ON THE SURFACE TENSION OF THE MEMBRANE LINING PULMONARY ALVEOLI AND ON PULMONARY SUSCEPTIBILITY CURVE.
24947 APTIC NO. 45370

BILLINGS C E

MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE.
*24536 APTIC NO. 46097

BLACK F M

A TOTAL CHEMILUMINESCENT METHOD FOR NO AND NOX (NO + NO2) ANALYSIS.
*24747 APTIC NO. 45785

BLANCO A J

AN INFRA-RED SPECTROSCOPIC VIEW OF ATMOSPHERIC PARTICULATES OVER EL PASO, TEXAS.
*24790 APTIC NO. 45756

BLASCHKE W

CALCULATION OF PROFITS AND PROFITABILITY OF POWER COAL CLEANING DEPENDING ON THE ACCEPTED ASH CONTENT IN THE CONCENTRATE.
*24984 APTIC NO. 45637

BLASS E

FLOW STUDIES ON A BUBBLE-COLUMN CASCADE REACTOR WITH UNIDIRECTIONAL FLOW OF GAS AND LIQUID.
*24856 APTIC NO. 45675

BLOSSER R O

MISCELLANEOUS SOURCES AND TRENDS IN KRAFT EMISSION CONTROL: OVERVIEW.
*24622 APTIC NO. 45749

BLURTON K F

REFUELABLE BATTERIES.
*24537 APTIC NO. 45878

BOEHLEN B

THE SPATIAL DEVELOPMENT OF ELECTRIC FIELDS AND SPACE CHARGE DENSITY IN PLATE ELECTROSTATIC PRECIPITATORS.
24659 APTIC NO. 45679

BOEHNKE H

SAMPLING AND ANALYTICS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AUTOMOBILE EXHAUST GAS. I. OPTIMIZATION OF THE COLLECTING ARRANGEMENT - ENRICHMENT OF THE POLYCYCLIC AROMATIC HYDROCARBONS.
24756 APTIC NO. 46365

BORESKOV G K

EPR STUDY OF THE CONDITION OF COPPER INVOLVED IN THE COPPER-MAGNESIUM OXIDATION CATALYST.
24873 APTIC NO. 45371

THE MECHANISM OF CARBON MONOXIDE OXIDATION OCCURRING ON METAL OXIDE SURFACES. I. STUDYING THE GRADUAL PROCESS OF CARBON MONOXIDE OXIDATION ON VANADIUM PENTOXIDE SURFACES.
24664 APTIC NO. 45373

BOTTS M V
THE MOLTEN CARBONATE PROCESS FOR SULFUR DIOXIDE REMOVAL FROM STACT GASES: PROCESS DESCRIPTION, ECONOMIS, PILOT PLANT DESIGN.
*24623 APTIC NO. 46348

BOUBEL R W
A STUDY OF FLUIDIZED BED FILTERS SUBJECTED TO HIGH RADIAL ACCELERATIONS.
*24726 APTIC NO. 45532

BOUCOT K R
THE PHILADELPHIA PULMONARY NEOPLASM RESEARCH PROJECT: BASIC RISK FACTORS OF LUNG CANCER IN OLDER MEN.
*24915 APTIC NO. 45752

BOURBON P
BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
*24791 APTIC NO. 46113
STUDYING FLUORINE EMISSIONS FROM PHOSPHORIC ACID AND FERTILIZER MANUFACTURING SOURCES.
*24538 APTIC NO. 46119

BOYUM A A
CATALYTIC PURIFICATION OF NITRIC ACID TAIL GAS: A NEW APPROACH.
24728 APTIC NO. 45618

BREUER H
PROGRESS IN THE COMBAT AGAINST DUST AND SILICOSIS.
*24539 APTIC NO. 46355

BREUILLAUD J
BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

BROMBERG S
AIR POLLUTION AND SCHOOL ABSENTEEISM IN THREE SOUTHEASTERN CITITES FROM OCTOBER 1969 TO MARCH 1970.
24919 APTIC NO. 45879

BROUET G
A STUDY OF PULMONARY DUST DEPOSITS USING THE ELECTRON MICROSCOPE IN CONJUNCTION WITH THE ELECTRON SOUND ANALYSER.
24930 APTIC NO. 46150

BROWN G N
SO2 RECOVERY VIA ACTIVATED CARBON.
*24624 APTIC NO. 46153

BROWN T D
NOX FORMATION IN COMBUSTION.
24898 APTIC NO. 45754

BRUNOW G
REACTIONS OF SULPHUR DURING SULPHATE PULPING.
*24540 APTIC NO. 45439

BRYSIN V G
ON THE CONCENTRATIONS OF ALLERGENIC POLLENS AND MOLDS IN THE ATMOSPHERE.
24796 APTIC NO. 45661

BUEHNE K W
RECORDING DUST EMISSION MEASUREMENT IN THE CEMENT INDUSTRY WITH THE SMOKE DENSITY MEASURING UNIT RM 4 OF THE COMPANY SICK.
*24748 APTIC NO. 46377

BURKITT A
DISTRIBUTION OF HEAVY METALS IN THE VICINITY OF AN INDUSTRIAL COMPLEX.
*24800 APTIC NO. 45750

BYKOV A P
AEROSOL SEDIMENTATION MECHANISMS OCCURRING IN WATER VAPOR DIFFUSION FIELDS.
24897 APTIC NO. 45713

BYRNE W M JR
A DIFFERENTIAL METHOD FOR THE PREDICTION OF THE EFFECTS OF ATMOSPHERIC BOUNDARY LAYER TURBULENCE USING THE TURBULENCE KINETIC ENERGY EQUATION.
*24842 APTIC NO. 45375

BYZOVA N L
METHOD OF EVALUATING ATMOSPHERIC DIFFUSION FROM TURBULENT CHARACTERISTICS.
*24801 APTIC NO. 46014

C

CADORIN D
NUCLEATION, GROWTH AND COAGULATION OF SOLID PARTICLES IN FLAMES.
24857 APTIC NO. 45741

CALAFIORE D
AIR POLLUTION AND SCHOOL ABSENTEEISM IN THREE SOUTHEASTERN CITITES FROM OCTOBER 1969 TO MARCH 1970.
24919 APTIC NO. 45879

CALDWELL R L
MERCURY IN THE ENVIRONMENT.
*24541 APTIC NO. 46053

CALLAHAN J M
GM S HOTTEST AUTOMOTIVE EMISSION ELIMINATOR.
*24625 APTIC NO. 46182

CALVERT S
ENVIRONMENTAL CONTROL.
*25015 APTIC NO. 45447

CARLSON C E
ENVIRONMENTAL POLUTION BY FLUORIDES IN FLATHEAD NATIONAL FOREST AND GLACIER NATIONAL PARK.
*24968 APTIC NO. 45604

CARNAHAN W J
THE PHILADELPHIA PULMONARY NEOPLASM RESEARCH PROJECT: BASIC RISK FACTORS OF LUNG CANCER IN OLDER MEN.
24915 APTIC NO. 45752

CARROLL B R
VOLATILIZATION OF DIELDRIN FROM FALLOW SOIL AS AFFECTED BY DIFFERENT SOIL WATER REGIMES.
24585 APTIC NO. 46188

CARTER H B
OZONE INDUCED FOLIAR INJURY IN LETTUCE AND RADISH CULTIVARS.
24963 APTIC NO. 45865

CATANEO R
INTERACTIONS BETWEEN EQUAL-SIZED DROPLETS DUE TO THE WAKE EFFECT.
*24908 APTIC NO. 45621

CAYROL E
A STUDY OF PULMONARY DUST DEPOSITS USING THE ELECTRON MICROSCOPE IN CONJUNCTION WITH THE ELECTRON SOUND ANALYSER.
24930 APTIC NO. 46150

CHANG C W
THE INFLUENCE OF OZONE ON GROWTH AND RIBOSOMAL RNA IN PINTO BEAN PLANTS.
*24953 APTIC NO. 45616

CHE M
ESR AND IR STUDIES ON THE ADSORPTION AND DISPROPORTIONATION OF NITRIC OXIDE ON COPPER EXCHANGED Y ZEOLITES, AND OF REDUCTION BY CARBON MONOXIDE.
24997 APTIC NO. 46064

CHEN K
A MACROSYSTEM ANALYSIS OF THE HUMAN ENVIRONMENT.
*25038 APTIC NO. 45460

CHEN W Y
ON THE APPLICATION OF RICE S EXCEEDANCE STATISTICS TO ATMOSPHERIC TURBULENCE.
*24802 APTIC NO. 45393

CHIBA Y
HYDROCHLORIC ACID RECOVERY METHOD FROM THE EMISSION GAS OF PLASTIC WASTE HEAT TREATMENT.
*24626 APTIC NO. 45396

CHIGRINA V A
EPR STUDY OF THE CONDITION OF COPPER INVOLVED IN THE COPPER-MAGNESIUM OXIDATION CATALYST.
24873 APTIC NO. 45371

CHIN S
THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

CHIZHOV YU V
INVESTIGATION OF SPONTANEOUS IONIZATION PROCESS IN NITRIC OXIDE BY MEANS OF PHOTOELECTRON SPECTROSCOPY.
24869 APTIC NO. 45642

CHNG K M
ASSESSING THE IMPACT OF AIRCRAFT EMISSIONS UPON AIR QUALITY.
24569 APTIC NO. 45860

CHURG J
CARCINOGENICITY OF AMOSITE ASBESTOS.
24933 APTIC NO. 46135

CHVIRUK V P
KINETICS OF THE VAPORIZATION OF MERCURY FROM SODIUM HYDROXIDE SOLUTIONS.
*24542 APTIC NO. 45427

CLAVERT J G
MECHANISM OF CARBON DIOXIDE FORMATION IN 3130-A IRRADIATED MIXTURES OF SULFUR DIOXIDE AND CARBON MONOXIDE.
24901 APTIC NO. 45755

CLAYPOOL D W
FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS.
24969 APTIC NO. 45663

COCCONI L
THE POLLUTION CONTROL CENTER OF THE PROVINCIAL ADMINISTRATION OF MODENA.
*25016 APTIC NO. 45726

COHEN S M
NITROGEN OXIDE EMISSIONS FROM A FLUIDIZED BED REACTOR.
24657 APTIC NO. 46221

COLEMAN J H
ATMOSPHERIC CHEMICAL INTERACTIONS IN COAL-FIRED POWER PLANT PLUMES.
24809 APTIC NO. 46096

COLLINS M F
CATALYTIC PURIFICATION OF NITRIC ACID TAIL GAS: A NEW APPROACH.
24728 APTIC NO. 45618

COLOMBO U
SOOT IN FLAMES: THE TECHNOLOGICAL SIGNIFICANCE OF THE PROBLEMS OF SOOT AND OTHER PARTICLES FORMED IN FLAMES.
*24543 APTIC NO. 45747

COMPTON O C
FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS.
*24969 APTIC NO. 45663

CONIGLIO W R
MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE.
24536 APTIC NO. 46097

CONNER W D
REMOTE MEASUREMENT OF SMOKE PLUME TRANSMITTANCE USING LIDAR.
24749 APTIC NO. 46088

CONRADS L A
THE KRECKE RAIN GAUGE OF 1849 AND ITS USE IN A STUDY ON THE INFLUENCE OF UTRECHT CITY ON THE CHEMICAL COMPOSITION OF THE RAIN WATER.
*24843 APTIC NO. 45573

COOK S C
REMOTE MEASUREMENT OF SMOKE PLUME TRANSMITTANCE USING LIDAR.
*24749 APTIC NO. 46088

COOPER D A
THE PHILADELPHIA PULMONARY NEOPLASM RESEARCH PROJECT: BASIC RISK FACTORS OF LUNG CANCER IN OLDER MEN.
24915 APTIC NO. 45752

COVENTRY D H
GRAPHS FOR ESTIMATING MAXIMUM FUMIGATION CONCENTRATIONS.
24835 APTIC NO. 4579

COX W J
EFFECT OF LIME ON LEAD UPTAKE BY FIVE PLANT SPECIES.
*24954 APTIC NO. 46073

COZZI C
NUCLEATION, GROWTH AND COAGULATION OF SOLID PARTICLES IN FLAMES.
*24857 APTIC NO. 45741

CRAIG T L
COMMERCIAL EXPERIENCE WITH AN SO2 RECOVERY PROCESS.
24680 APTIC NO. 46151

CRAMER J J
MATHEMATICAL MODELS OF CHEMICAL POLLUTION OF THE ENVIRONMENT.
*24844 APTIC NO. 45350

CRECELIUS H J
SEPARATION OF NICOTINE AEROSOLS FOR THE DETERMINATION OF NICOTINE IN INDOOR AIR.
*24627 APTIC NO. 45668

CROSBY D G
VAPOR-PHASE PHOTODECOMPOSITION OF PESTICIDES.
24877 APTIC NO. 46059

CROSS F L
UPDATING INCINERATORS TO MEET CURRENT CRITERIA.
*24628 APTIC NO. 45365

CROSS F L JR
IS INCINERATION THE ONLY ALTERNATIVE FOR CONTROLLING AIR POLLUTION EMISSIONS FROM THE MANUFACTURE OF STEEL SHIPPING CONTAINERS? Preprint, American Inst. of Chemical Engineers, New York, 30p., 1972. 5 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 72nd, St. Louis, Mo., May 21-24, 1972.)
24629 APTIC NO. 46035
COMPLYING WITH AIR QUALITY STANDARDS.
24998 APTIC NO. 46054
AIR FLOW IN STACKS.
*24753 APTIC NO. 46327
INCINERATION OF INDUSTRIAL WASTES.
*24544 APTIC NO. 45576
INTRODUCTION TO EMISSION TESTING.
*24750 APTIC NO. 45592
GASEOUS SOURCE SAMPLING.
*24751 APTIC NO. 45932
ISOKINETIC SAMPLING.
*24752 APTIC NO. 45944
ESTIMATION OF ENVIRONMENTAL IMPACT FROM POINT SOURCE AIR POLLUTION EMISSIONS.
*25017 APTIC NO. 45956

CVETANOVIC R J
RELATIVE RATE OF REACTION OF O(1D2) WITH N2O.
24881 APTIC NO. 45386

D

D ALLEVA B A
EFFECTS OF GASOLINE AROMATIC AND LEAD CONTENT ON EXHAUST HYDROCARBON REACTIVITY.
24864 APTIC NO. 46057

DABY E E
ANALYSIS OF OZONE AND NITRIC OXIDE BY A CHEMILUMINESCENT METHOD IN LABORATORY AND ATMOSPHERIC STUDIES OF PHOTOCHEMICAL SMOG.
24779 APTIC NO. 46080

DANCHEV P
BULGARIAN COPPER FOUNDRY-GENERATED DUSTS AND THEIR PROPERTIES.
*24545 APTIC NO. 45419

DARNALL K R
REACTION OF PEROXYACETYL NITRATE WITH NITRIC OXIDE.
24888 APTIC NO. 45605

DAVIS W K
ESTIMATION OF ENVIRONMENTAL IMPACT FROM POINT SOURCE AIR POLLUTION EMISSIONS.
25017 APTIC NO. 45956

DAVISON W R
A FEASIBILITY ANALYSIS OF A SIMPLE CYCLE GAS TURBINE ENGINE FOR AUTOMOBILES.
24586 APTIC NO. 46094

DEHAAS N

RELATIVE RATE CONSTANTS FOR O + HCO YIELDS OH + CO AND O + HCO YIELDS H + CO2.
24903 APTIC NO. 45414

DEL VALLE E G

LABORATORY STUDIES AND MATHEMATICAL MODELING OF NOX FORMATION IN COMBUSTION PROCESSES. (FINAL REPORT).
24907 APTIC NO. 45591

DENNIS R B

SPECTROSCOPY BETWEEN 5 AND 6 MICRON WITH A TUNABLE SPIN-FLIP RAMAN SOURCE.
24783 APTIC NO. 45432

DERAYGIN B V

CONDENSATION METHOD OF RECOVERING HIGH-DISPERSIVE FRACTION OF BIOLOGICAL AEROSOLS AND DETERMINATION OF THEIR QUANTITATIVE CONCENTRATION.
*24754 APTIC NO. 46152

DESCOLAS J

THE ACTION TAKEN BY DUST SEPARATORS MANUFACTURERS.
*24727 APTIC NO. 45544

DEWEY J E

ENVIRONMENTAL POLUTION BY FLUORIDES IN FLATHEAD NATIONAL FOREST AND GLACIER NATIONAL PARK.
24968 APTIC NO. 45604

DIAZ R J

USE OF SPENT STUMPWOOD IN LINERBOARD PRODUCTION.
24698 APTIC NO. 45740

DICKSON SIMPSON J

MAKING DIESELS SOCIABLE.
*24630 APTIC NO. 46120

DIJKSTRA F

INCINERATION OF GASEOUS AND LIQUID WASTES.
24674 APTIC NO. 46381

DJOLOV G

TURBULENT DIFFUSION OF IMPURITIES IN A STATIONARY STRATIFIED BOUNDARY LAYER OF THE ATMOSPHERE.
*24845 APTIC NO. 45491

DOBKINA YE I

HYDROGEN SULFIDE CONVERSION ON PALLADIUM CATALYST.
24670 APTIC NO. 45641

DOBROZRAKOVA N I

METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

DODD H C

CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE.
24935 APTIC NO. 45651

DONGA G

STUDIES ON EXTENDING THE ACTIVITY OF AN AFTER-BURNER CATALYST.
24690 APTIC NO. 46356

DONOSO H

PREVALENCE OF CHRONIC BRONCHITIS IN URBAN AND RURAL AREAS OF SANTIAGO AND ITS RELATION WITH AIR POLLUTION INDEXES.
24929 APTIC NO. 45599

DRUGMAND L

DISPERSION OF GASEOUS POLLUTANTS IN THE AIR.
*24846 APTIC NO. 45666

DU TOIT W J F

TEMPERATURE STRUCTURE ABOVE CITIES: REVIEW AND PRELIMINARY FINDINGS FROM THE JOHANNESBURG URBAN HEAT ISLAND PROJECT.
24836 APTIC NO. 45753

DUEWEL L

RECORDING DUST EMISSION MEASUREMENT IN THE CEMENT INDUSTRY WITH THE SMOKE DENSITY MEASURING UNIT RM 4 OF THE COMPANY SICK.
24748 APTIC NO. 46377

DVORNIKOV A G

MERCURY IN DONBASS COALS.
*24591 APTIC NO. 45368

INCREASED CONCENTRATIONS IN CERTAIN COAL FRACTIONS.
*24909 APTIC NO. 45369

DYCK G V

SOME PROBLEMS RELATED TO METALS OCCURRING IN THE DOMESTIC REFUSE TREATMENT PLANTS.
*24546 APTIC NO. 46149

DZHOBADZE A S

AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES.
24663 APTIC NO. 46132

E

ECKERT B

STATE OF DEVELOPMENT OF AUTOMOBILE GAS TURBINES. PART 2.
*24547 APTIC NO. 46363

EGUSA S

HEAT MANAGEMENT AND POLLUTION CONTROL IN PAPER FACTORIES.
*24631 APTIC NO. 45410

EICKELPASCH D

CARBON MONOXIDE IN STEEL PRODUCTION.
*24548 APTIC NO. 45958

ELIKAN L

EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
24723 APTIC NO. 45475

ELLIOTT S

FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS.
24969 APTIC NO. 45663

ELSMLIE R G

FACTUAL STUDIES OF REAL CAUSES OF AIR POLLUTION.
*24549 APTIC NO. 46294

EMI H

COLLECTION EFFICIENCIES OF AEROSOLS BY FIBROUS PACKED BED UNDER THE INFLUENCE OF GRAVITY.
*24633 APTIC NO. 46114

AIR CLEANING DEVICE.
*24632 APTIC NO. 45444

EMI J

FLOW ANALYSIS OF POROUS FILTER AND PARTICLE INERTIA COLLECTION RATE.
24879 APTIC NO. 46154

THE EFFECT OF MUTUAL INTERFERENCE OF FIBERS IN AN EXPERIMENTAL FIBER PACKED LAYER FILTERING PROCESS.
24677 APTIC NO. 46165

ENGELKEMEIR A

THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE.
24834 APTIC NO. 46236

ENGLEMAN V S

LABORATORY STUDIES AND MATHEMATICAL MODELING OF NOX FORMATION IN COMBUSTION PROCESSES. (FINAL REPORT).
24907 APTIC NO. 45591

ERICKSON R A

MRG PROCESS FOR SNG.
24577 APTIC NO. 46166

ESAKI N

OXYGEN BLAST FURNACE EMISSION GAS CONTROL METHOD.
24649 APTIC NO. 45397

ETSUZENYA S

ELECTROSTATIC PRECIPITATOR.
*24634 APTIC NO. 45672

EVANS M J B

THE KINETICS OF ADSORPTION OF CARBON MONOXIDE ON ALUMINA.
24893 APTIC NO. 45758

EVLANOV S F

PREPARATION OF REDUCING GAS WITH HIGH HYDROGEN CONTENT BY THE PYROLYSIS OF NATURAL METHANE IN MELTS.
24559 APTIC NO. 45387

EZHOV B M
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

F

FAGARASH M B
PHOTOLYSIS OF THE TRIFLUOROACETIC ACID ANHYDRIDE.
*24858 APTIC NO. 45374

FAIRCHILD G A
EFFECTS OF SULFUR DIOXIDE ON THE NASAL MUCOSA OF MICE.
24918 APTIC NO. 46133
ATMOSPHERIC POLLUTANTS AND THE PATHOGENESIS OF VIRAL RESPIRATORY INFECTION. SULFUR DIOXIDE AND INFLUENZA INFECTION IN MICE.
*24916 APTIC NO. 46157

FALLER F E
TESTING ANODIZED ALUMINUM IN ACCELERATED AND NATURAL WEATHERING TESTS.
24979 APTIC NO. 46358

FEDOROVA YE O
AMMONIA INFRARED SPECTRA IN ATMOSPHERE.
24794 APTIC NO. 45353

FELDER R M
POLYMERIC BARRIERS AS INTERFACES IN STACK SAMPLING.
24775 APTIC NO. 45851

FERRELL J K
POLYMERIC BARRIERS AS INTERFACES IN STACK SAMPLING.
24775 APTIC NO. 45851

FESENKO A V
APPLICATION OF THE MICROCATALYTIC IMPULSE AND ISOTOPE METHODS TO THE STUDY OF THE CARBON MONOXIDE CATALYTIC OXIDATION MECHANISM ON CUPRIC OXIDE.
*24635 APTIC NO. 45904

FESENKO L A
PHASE CONVERSION OF TARRY PRODUCTS OCCURRING IN GASES EMITTED BY ALUMINUM ELECTROLYSIS WORKSHOPS.
24560 APTIC NO. 45420

FIORE M E
UPDATING INCINERATORS TO MEET CURRENT CRITERIA.
24628 APTIC NO. 45365

FIRNHABER R B
EXHAUST GAS CLEANING BY ENGINE MODIFICATION. LESS POLLUTANTS BY EXHAUST GAS RETURN, CARBURETOR AND EXHAUST MODIFICATIONS.
*24636 APTIC NO. 45662

FISCHER W H
PARTICLE PRODUCTION BY POLYMER PYROLYSIS: MASS SPECTROMETRIC INVESTIGATIONS.
*24859 APTIC NO. 45960

FISHER J L
ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION: TECHNOLOGY AND PUBLIC POLICY.
*25044 APTIC NO. 45458

FISHER T N
CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE.
24935 APTIC NO. 45651

FITES R C
FOLIAR SENSITIVITY OF SOYBEANS TO OZONE AS RELATED TO SEVERAL LEAF PARAMETERS.
24964 APTIC NO. 45773

FLEMING R D
DIESEL EMISSIONS AS RELATED TO ENGINE VARIABLES AND FUEL CHARACTERISTICS.
24734 APTIC NO. 45476

FLETCHER B C
THE ENHANCEMENT OF ORANGE OIL OXIDATION BY SULPHUR DIOXIDE.
24952 APTIC NO. 46087

FLOWERS N C
THE ELECTRICAL SEQUELAE OF AEROSOL INHALATION.
*24917 APTIC NO. 45706

FONTIJN A
COMPARISON OF THE ABSOLUTE QUANTUM YIELDS OF THE GAS-PHASE O/NO REACTION AND THE LIQUID-PHASE LUMINOL OXIDATION CHEMILUMINESCENCE INTENSITY STANDARDS.
*24860 APTIC NO. 46168

FORIZS S
SULFUR AND VOLATILES BEHAVIOR DURING COKING AND THEIR DISTRIBUTION OVER THE VARIOUS GRAIN-SIZE CLASSES OF COKE.
*24592 APTIC NO. 45381

FORWERG W
SEPARATION OF NICOTINE AEROSOLS FOR THE DETERMINATION OF NICOTINE IN INDOOR AIR.
24627 APTIC NO. 45668

FOX E B
UPDATING INCINERATORS TO MEET CURRENT CRITERIA.
24628 APTIC NO. 45365

FRI R W
ENVIRONMENTAL PROTECTION AGENCY. (40 CFR PART 60). STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES. EMISSIONS DURING STARTUP, SHUTDOWN AND MALFUNCTION.
*24992 APTIC NO. 45450

FRIEDLANDER G D
FORD, FUELS, AND YOUR FUTURE.
*25018 APTIC NO. 45767

FRYAZINOV V V
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

FUECHSEL R
POSSIBILITIES FOR ELIMINATING THE POLLUTANTS IN WATER CAUSED BY SULFITE CELLULOSIS PLANTS.
*24637 APTIC NO. 45705

FUGGLE R F
TEMPERATURE STRUCTURE ABOVE CITIES: REVIEW AND PRELIMINARY FINDINGS FROM THE JOHANNESBURG URBAN HEAT ISLAND PROJECT.
24836 APTIC NO. 45753

FUJII F
ELIMINATION METHOD FOR LIGHT-WEIGHT DUST RESIDUE ON FILTER.
*24638 APTIC NO. 45626

FUJII S
CONTROL OF AIR POLLUTION INDOORS.
*24639 APTIC NO. 45728

FUJIWARA G
VENTURI SCURBBER FOR HIGH TEMPERATURE CORROSIVE GAS.
*24640 APTIC NO. 45627

FUKUMOTO T
TREATMENT OF COMBUSTION GAS FROM POLYVINYL CHLORIDE AND TIRES.
*24641 APTIC NO. 45694

FUKUSHIMA Y
STUDIES ON ODOR EVALUATIONS IN TOKYO.
24556 APTIC NO. 45654

G

GALL R
CITIZEN PARTICIPATION IN AIR QUALITY MANAGEMENT.
25035 APTIC NO. 45911

GALLE P
A STUDY OF PULMONARY DUST DEPOSITS USING THE ELECTRON MICROSCOPE IN CONJUNCTION WITH THE ELECTRON SOUND ANALYSER.
24930 APTIC NO. 46150

GARDNER D E
ENVIRONMENTAL INFLUENCES ON LIVING ALVEOLAR MACROPHAGES.
*24945 APTIC NO. 45587

GARGER YE K
SCATTERING OF SMOKE FROM A HIGH-LEVEL POINT SOURCE.
*24803 APTIC NO. 46015

GARTRELL F E
ATMOSPHERIC CHEMICAL INTERACTIONS IN COAL-FIRED POWER PLANT PLUMES.
24809 APTIC NO. 46096

GEBELEIN H
ON THE RELATION BETWEEN NON ADIABATIC UNIMOLECULAR REACTIONS AND RADIATIONLESS PROCESSES.
*24861 APTIC NO. 45720

GHOSE S K
METEOROLOGY AND OUR ENVIRONMENT.
*24804 APTIC NO. 45459

GHOSH A K
HYDROGEN SULPHIDE - ITS HAZARDS AND A NEW DETECTOR TUBE FOR ITS SPOT ESTIMATION.
*24786 APTIC NO. 45361

GIDDENS W E JR
EFFECTS OF SULFUR DIOXIDE ON THE NASAL MUCOSA OF MICE.
*24918 APTIC NO. 46133

GILES C H
EFFECTS OF GASEOUS DIFFUSION IN THE SUBSTRATE ON LIGHT FASTNESS OF DYES.
*24977 APTIC NO. 45473

GILLESPIE G R
CATALYTIC PURIFICATION OF NITRIC ACID TAIL GAS: A NEW APPROACH.
*24728 APTIC NO. 45618

GIROUX M
BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

GIUFFRIDA L
LIQUID CHROMATOGRAPHY OF POLYNCYCLIC AROMATIC HYDROCARBONS.
24762 APTIC NO. 45739

GLESER M A
EFFECT OF CARBON MONOXIDE ON OXYGEN TRANSPORT DURING EXERCISE.
24941 APTIC NO. 45404

GLICK M
THE ANALYSIS OF RESPIRATORY INCAPACITY IN COAL MINE WORKERS OF NEW SOUTH WALES.
*24946 APTIC NO. 45362

GLOGER J
DETERMINING THE FRACTIONAL SEPARATING EFFICIENCY OF CENTRIFUGAL SEPARATORS AS A FUNCTION OF THE ORIGINAL DUST CONCENTRATION AND THE CYCLONE INLET FLOW RATE.
24733 APTIC NO. 45470

GNATYUK N A
MN TYPE GAS ANALYZER ALIGNMENT FOR THE AUTOMATIC CONTROL OF THE AIR REGIME IN OPERATING BOILERS.
24681 APTIC NO. 45634

GNYP A W
PROBLEMS IN STACK SAMPLING: PART II--TAKING THE FIRST STEPS.
*24755 APTIC NO 45445

GOLDBERG H E
AIR POLLUTION AND SCHOOL ABSENTEEISM IN THREE SOUTHEASTERN CITITES FROM OCTOBER 1969 TO MARCH 1970.
*24919 APTIC NO. 45879

GOLDBERG S A
DIRECT INFRARED ANALYSIS OF ALPHA QUARTZ DEPOSITED ON FILTERS.
24782 APTIC NO. 45355

GOLUBEV A I
ATMOSPHERIC CORROSION OF LOW-ALLOYED STEELS.
24980 APTIC NO. 46112

GORDON G M
BULGARIAN COPPER FOUNDRY-GENERATED DUSTS AND THEIR PROPERTIES.
24545 APTIC NO. 45419

GORLIN S M
STUDY OF THE INFLUENCE OF IRREGULARITIES OF THE EARTH S SURFACE ON THE AIR FLOW CHARACTERISTICS IN A WIND TUNNEL.
*24805 APTIC NO. 46012

GOROSHKO B B
EXPERIMENTAL STUDIES OF ATMOSPHERIC POLLUTION IN INDUSTRIAL AREAS.
*24806 APTIC NO. 46019

GORYACHIY YA V
THE FUEL LAYER OCCURRING IN THE CARBURETOR INLET PIPE.
24535 APTIC NO. 45418

GOTHE C J
LEAD IN GASOLINE.
24679 APTIC NO. 46267

GOUGH W C
FUSION ENERGY AND THE FUTURE.
*24550 APTIC NO. 46048

GOUSSET P
THE ACTION AGAINST NUISANCES AS CONDUCTED SINCE THE DEBUT OF INDUSTRIALIZATION.
*25039 APTIC NO. 45555

GRAHAM W A
ALKYLATION INTEGRATES ACID PLANT.
*24642 APTIC NO. 46076

GREEN W H
LASER-EXCITED VIBRATIONAL RELAXATION STUDIES OF HYDROGEN FLUORIDE.
24862 APTIC NO. 46162

GREENWALD L E
A FEASIBILITY ANALYSIS OF A SIMPLE CYCLE GAS TURBINE ENGINE FOR AUTOMOBILES.
24586 APTIC NO. 46094

GREENWAY A R
DETERMINATION OF MAXIMUM EMISSION RATES TO MEET AIR QUALITY STANDARDS.
*24847 APTIC NO. 45383

GRIFFIN R M
MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE.
24536 APTIC NO. 46097

GRIFFITH W C
POLLUTION CONTROL PROBLEMS OF THERMOPHYSICAL INTEREST.
*24551 APTIC NO. 45392

GRIMMER G
SAMPLING AND ANALYTICS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AUTOMOBILE EXHAUST GAS. I. OPTIMIZATION OF THE COLLECTING ARRANGEMENT - ENRICHMENT OF THE POLYCYCLIC AROMATIC HYDROCARBONS.
*24756 APTIC NO. 46365

GRYAZNOV V A
QUASI-RADICAL REACTIONS OF NITROGEN OXIDES.
24883 APTIC NO. 45708

GUENTHER P
EXACT MEASUREMENT - CLEANER AIR.
*24757 APTIC NO. 46385

GUNJI Y
STUDIES ON DESULFURIZATION OF COKE MIXTURE PELLETS.
24651 APTIC NO. 46115

GUR YANOVA L N
HYDROGEN SULFIDE CONVERSION ON PALLADIUM CATALYST.
24670 APTIC NO. 45641

H

HAAGEN SMIT A J
ABATEMENT STRATEGY FOR PHOTOCHEMICAL SMOG.
*24848 APTIC NO. 45603

HAERING H U
THE ACTIVITIES OF THE OPERATIONS RESEARCH INSTITUTE IN THE FIELD OF ENVIRONMENTAL PROTECTION.
*25019 APTIC NO. 45656

HALE B N

MOLECULAR MODEL FOR PRENUCLEATION WATER CLUSTERS.
24826 APTIC NO. 45689

HALES J M

SCAVENGING OF GASEOUS TRITIUM COMPOUNDS BY RAIN.
*24807 APTIC NO. 46039

HALL R E

A STUDY OF AIR POLLUTANT EMISSIONS FROM OIL-FIRED DOMESTIC HEATING EQUIPMENT.
*24552 APTIC NO. 45810

HAMANAKA H

AIR QUALITY CRITERIA FOR NITROGEN OXIDES AND PHOTOCHEMICAL OXIDANTS.
*24993 APTIC NO. 45438

HAMM J R

EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
24723 APTIC NO. 45475

HAMMOND C

CARCINOGENICITY OF AMOSITE ASBESTOS.
24933 APTIC NO. 46135

HANCOCK J K

LASER-EXCITED VIBRATIONAL RELAXATION STUDIES OF HYDROGEN FLUORIDE.
*24862 APTIC NO. 46162

HANDMAN L M

EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
24723 APTIC NO. 45475

HANNA S R

DESCRIPTION OF ATDL COMPUTER MODEL FOR DISPERSION FROM MULTIPLE SOURCES.
*24808 APTIC NO. 45950

HARLEY R A

MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE.
24536 APTIC NO. 46097

HASHIMOTO A

THE ACCOMMODATION COEFFICIENTS OF CARBON MONOXIDE, OXYGEN, AND CARBON DIOXIDE ON PLATINUM.
*24863 APTIC NO. 46130

HASSELBLAD V

AIR POLLUTION AND SCHOOL ABSENTEEISM IN THREE SOUTHEASTERN CITITES FROM OCTOBER 1969 TO MARCH 1970.
24919 APTIC NO. 45879

HATTORI M

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

HAYAKAWA K

AIR POLLUTION IN CITIES AND ITS CONTROL MEASURES.
*24553 APTIC NO. 46089

HAYASHI K

DEODORIZATION DEVICE FOR CHICKEN EXCRETA DRYER.
24711 APTIC NO. 45347

HAYASHI M

EMISSION GAS FROM SOFT POLYVINYL CHLORIDE RESIN MANUFACTURING PLANT AND ITS TREATMENT.
*24643 APTIC NO. 45408

HAYASHI S

OXYGEN BLAST FURNACE EMISSION GAS CONTROL METHOD.
24649 APTIC NO. 45397

HAYASHI Y

PRACTICAL ANALYSIS OF EFFECT OF EXHAUST GAS RECIRCULATION ON NOX CONTROL.
24676 APTIC NO. 46155

HEAGLE A S

EFFECT OF PUCCINIA GRAMINIS F. SP. TRITICI ON OZONE INJURY IN WHEAT.
*24970 APTIC NO. 45615

HEARD G

DUST CONTROL AT OHIO VALLEY.
24735 APTIC NO. 45584

HEGGESTAD H E

PLANTS THAT WILL WITHSTAND POLLUTION AND REDUCE IT.
*24955 APTIC NO. 45540

HOW PLANTS FIGHT MAN-MADE POLLUTION.
*24956 APTIC NO. 45776

HEICKLEN J

THE REACTION OF OH WITH NO2.
24891 APTIC NO. 46229

ON THE PRODUCTION OF N2O FROM THE REACTION OF O(1D) WITH N2.
24890 APTIC NO. 45687

HEIN K

RECENT RESULTS ON THE FORMATION AND COMBUSTION OF SOOT IN TURBULENT FUEL OIL AND GAS FLAMES.
*24554 APTIC NO. 45732

HEISTAD D D

EFFECT OF CARBON MONOXIDE ON REFLEX VASOCONSTRICTION IN MAN.
*24920 APTIC NO. 45657

HELDMAN D R

INFLUENCE OF AIR TURBULENCE ON RE-ENTRAINMENT OF SMALL PARTICLES FROM FLAT SURFACES.
24884 APTIC NO. 45746

HELLEMANS J

THE CONTRIBUTION OF INDUSTRY TO ENVIRONMENTAL POLLUTION CONTROL.
*24729 APTIC NO. 45577

HENNING H

THE CALCULATION OF THE PERFORMANCE OF COOLING TOWERS.
*24555 APTIC NO. 45681

HEUSS J M

EFFECTS OF GASOLINE AROMATIC AND LEAD CONTENT ON EXHAUST HYDROCARBON REACTIVITY.
*24864 APTIC NO. 46057

HIGH D M

EXHAUST GAS CONVERSION FACTORS.
24562 APTIC NO. 45858

HIRAI K

POLLUTIONLESS NITRIZATION METHOD NI-TEMPER PROCESS.
24702 APTIC NO. 46126

HIRAIWA Y

TREATMENT OF COMBUSTION GAS FROM POLYVINYL CHLORIDE AND TIRES.
24641 APTIC NO. 45694

HIRAKAWA K

REDUCING SULFUR CONTENT IN FUEL AND FLUE-GAS DESULFURIZATION.
*24644 APTIC NO. 46092

HIRAOKA M

PREDICTION OF URBAN SCALE AIR POLLUTION.
24810 APTIC NO. 45402

HISHIDA K

PROBLEMS OF PLASTIC WASTE COMBUSTION AND THEIR CONTROL.
*24645 APTIC NO. 45690

HOEFT R G

NITROGEN AND SULFUR IN PRECIPITATION AND SULFUR DIOXIDE IN THE ATMOSPHERE IN WISCONSIN.
*24792 APTIC NO. 46074

EFFECT OF CARRIER, RATE, AND TIME OF APPLICATION OF S ON THE YIELD, AND S AND N CONTENT OF ALFALFA.
*24971 APTIC NO. 45558

ATMOSPHERIC CONTRIBUTION OF S AND N IN WISCONSIN.
*24972 APTIC NO. 45559

HOGSTROM U

A METHOD FOR PREDICTING ODOUR FREQUENCIES FROM A POINT SOURCE.
*24758 APTIC NO. 45703

HOLAK W

SIMPLE, RAPID DIGESTION TECHNIQUE FOR THE DETERMINATION OF MERCURY IN FISH BY FLAMELESS ATOMIC ABSORPTION.
*24957 APTIC NO. 45712

HONMA K

MEAN PARTICLE SIZE MEASURING METHOD FOR AEROSOL, USING FILTER COLLECTION MECHANISM.
*24759 APTIC NO. 45430

THE EFFECTS OF HEAVY METAL AEROSOL PARTICLE SIZES ON DEPOSIT IN LUNGS.
*24921 APTIC NO. 45431

THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS. (NO. 3).
24932 APTIC NO. 45683

HOOVER W L

COLLABORATIVE STUDY OF A METHOD FOR DETERMINING LEAD IN PLANT AND ANIMAL PRODUCTS.
*24958 APTIC NO. 45711

HORAN L G

THE ELECTRICAL SEQUELAE OF AEROSOL INHALATION.
24917 APTIC NO. 45706

HORIUCHI N

OXIDATION REACTION OF SULFUR DIOXIDE IN THE AIR.
24895 APTIC NO. 46143

HOROWITZ A

MECHANISM OF CARBON DIOXIDE FORMATION IN 3130-A IRRADIATED MIXTURES OF SULFUR DIOXIDE AND CARBON MONOXIDE.
24901 APTIC NO. 45755

HOSEMANN P J

ASPECTS OF THE TESTING OF SMOKE INDICATORS.
*24760 APTIC NO. 45652

THE THEORY OF IONIZATION MEASUREMENT CHAMBERS WITH SPECIAL CONSIDERATION OF THE RECOMBINATION OF SMALL IONS.
*24865 APTIC NO. 45678

HOSKO M J

CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE.
24935 APTIC NO. 45651

HOUSE C

STATEMENT OF CHARLES HOUSE, MEMBER COLORADO AIR POLLUTION COMMITTEE.
*24593 APTIC NO. 45556

HOUTEN J G T

SOURCE, DISPERSION AND EFFECT OF CHEMICAL AIR POLLUTANTS.
*24959 APTIC NO. 46338

HOWARD J Y

PROPOSED EXPERIMENTAL PROGRAMS FOR TESTING REMOTE SENSING APPLICATIONS IN THE METROPOLITAN WASHINGTON AREA. (FINAL REPORT).
24768 APTIC NO. 46277

HUANG C M

ATMOSPHERIC CHEMICAL INTERACTIONS IN COAL-FIRED POWER PLANT PLUMES.
*24809 APTIC NO. 46096

HUETTNER D A

NUCLEAR AND FOSSIL STEAM PLANTS: SOME SCALE, COST AND ENVIRONMENTAL CONSIDERATIONS.
*24985 APTIC NO. 45833

HUGO P

MECHANISM OF THE CARBON MONOXIDE CHEMISORPTION ON PLATINUM CATALYST APPLIED TO ALPHA-ALUMINA SUPPORT.
24650 APTIC NO. 45671

I

IAMMARTINO N R

TECHNOLOGY GEARS UP TO CONTROL FINE PARTICLES.
*24646 APTIC NO. 46170

IBERS J A

A NEW MODE OF SULFUR DIOXIDE ATTACHMENT TO HALOGENATED TRANSITION METAL COMPLEXES.
24892 APTIC NO. 45648

ICHIKARA Y

ELIMINATION METHOD FOR LIGHT-WEIGHT DUST RESIDUE ON FILTER.
24638 APTIC NO. 45626

IDE G

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

IKEDA Y

PREDICTION OF URBAN SCALE AIR POLLUTION.
*24810 APTIC NO. 45402

ILUS T

REACTIONS OF SULPHUR DURING SULPHATE PULPING.
24540 APTIC NO. 45439

IMADANI H

GAS-FIRING BOILER AS A METHOD OF POLLUTION CONTROL.
24558 APTIC NO. 45407

IMAI Y

POLLUTIONLESS NITRIZATION METHOD NI-TEMPER PROCESS.
24702 APTIC NO. 46126

IRVING M

FLOATING TANK-COVERS OFFER 90% CUT IN EVAPORATION LOSSES
*24647 APTIC NO. 45770

ISHIBASHI G

PRACTICAL EXAMPLE FOR DESULFURIZATION OF FLUE GAS BY SODIUM HYDROGEN SULFITE METHOD.
*24648 APTIC NO. 46148

ISHIGURO T

VARIOUS METHODS OF MEASUREMENTS AND EVALUATION OF ODOR POLLUTANTS AT THE EMISSION SOURCES AND ENVIRONMENT (II).
*24761 APTIC NO. 45422

STUDIES ON ODOR EVALUATIONS IN TOKYO.
*24556 APTIC NO. 45654

ITO K

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

ASCENDING AND DESCENDING CURRENTS RELATED TO PHOTOCHEMICAL SMOG PHENOMENA.
*24811 APTIC NO. 46273

IVANKOVA YE A

HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES.
24563 APTIC NO. 46308

IVANNIKOV V M

IMPROVING THE EFFICIENCY OF ASH TRAPPING AND ASH REMOVAL DEVICES DURING EXPLOITATION OF KANSK-ACHINSK COALS.
24695 APTIC NO. 45631

IVANOV A M

FORMAL KINETICS OF IRREVERSIBLE CHEMICAL REACTIONS OF SIMPLE TYPES BETWEEN GAS AND LIQUID, TAKING PLACE WITH A CHANGE IN VOLUME. GENERAL CASE OF CALCULATING THE REMOVAL OF LIQUID COMPONENTS WITH OFFGAS.
*24866 APTIC NO. 45664

IVANOV V I

USE OF PARAMETERS OF EULERIAN TURBULENCE FOR ESTIMATES OF LAGRANGIAN CHARACTERISTICS.
*24812 APTIC NO. 46013

IVES N F

LIQUID CHROMATOGRAPHY OF POLYNCYCLIC AROMATIC HYDROCARBONS.
*24762 APTIC NO. 45739

IWAO N

OXYGEN BLAST FURNACE EMISSION GAS CONTROL METHOD.
*24649 APTIC NO. 45397

IWASAKI Y

STUDIES ON ODOR EVALUATIONS IN TOKYO.
24556 APTIC NO. 45654

J

JACOBI W

DIFFUSION DEPOSITION OF SMALL-SIZED PARTICLES IN THE BRONCHIAL TREE.
24924 APTIC NO. 45360

JACOBS W R

MEASUREMENT OF THERMAL RADIATION SCATTERING CHARACTERISTICS OF SUBMICRON REFRACTORY PARTICLES.
*24910 APTIC NO. 45636

JAKUBITH M
MECHANISM OF THE CARBON MONOXIDE CHEMISORPTION ON PLATINUM CATALYST APPLIED TO ALPHA-ALUMINA SUPPORT.
*24650 APTIC NO. 45671

JENKINS D R
PROPOSED MODE OF ACTION OF ALKALINE EARTH METALS IN SUPPRESSING SOOT.
*24867 APTIC NO. 45734

JENSEN J D
DOPPLER ANEMOMETRY WITH A LASER DETECTOR.
24885 APTIC NO. 46123

JOHARI D P
EFFECTS OF GASEOUS DIFFUSION IN THE SUBSTRATE ON LIGHT FASTNESS OF DYES.
24977 APTIC NO. 45473

JOHN M K
LEAD UPTAKE BY LETTUCE AND OATS AS AFFECTED BY LIME, NITROGEN, AND SOURCES OF LEAD.
*24960 APTIC NO. 46071

JOHNSON S
BURNT IN THE NAME OF PROGRESS.
*24961 APTIC NO. 46263

JONKER P J
THE KRECKE RAIN GAUGE OF 1849 AND ITS USE IN A STUDY ON THE INFLUENCE OF UTRECHT CITY ON THE CHEMICAL COMPOSITION OF THE RAIN WATER.
24843 APTIC NO. 45573

JONSSON E
MAN AS MEASURING INSTRUMENT.
24766 APTIC NO. 46172

JORTNER J
ON THE RELATION BETWEEN NON ADIABATIC UNIMOLECULAR REACTIONS AND RADIATIONLESS PROCESSES.
24861 APTIC NO. 45720

JOYNER R W
LOW ENERGY ELECTRON DIFFRACTION STUDIES OF CHEMISORBED GASES ON STEPPED SURFACES OF PLATINUM.
24870 APTIC NO. 45456

JUNGE D C
A STUDY OF FLUIDIZED BED FILTERS SUBJECTED TO HIGH RADIAL ACCELERATIONS.
24726 APTIC NO. 45532

K

KAFAROV V V
A NEW METHOD FOR THE COMPUTATION OF CHEMISORPTION PARAMETERS.
*24868 APTIC NO. 45352

KAKUNAN T
THE RECENT SITUATION OF REGULATIONS ON AIR POLLUTION.
*24994 APTIC NO. 46081

KAMITANI K
STUDIES ON DESULFURIZATION OF COKE MIXTURE PELLETS.
*24651 APTIC NO. 46115

KANAGAWA A
SIZE DETERMINATION OF AEROSOL PARTICLES BY OWL-TYPE PHOTOMETER -- EFFECT OF WAVELENGTH RATIO-- (Owl gata fotometa ni yoru enmutai ryukei sokutei - hachohi no eikyo). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 36(6):647-653, June 1972. 5 refs.
24763 APTIC NO. 46117
FLOW ANALYSIS OF POROUS FILTER AND PARTICLE INERTIA COLLECTION RATE.
24879 APTIC NO. 46154

KANIA W
THE ACTION OF AIR ACTIVATION AND SULFUR DIOXIDE REDUCTION ON THE MAGNETIC PROPERTIES OF ALUMINUM-CHROMIUM CATALYSTS.
*24652 APTIC NO. 45721

KAPLAN M L
A MACROSCALE - MESOSCALE NUMERICAL MODEL OF INTENSE BAROCLINIC DEVELOPMENT.
*24813 APTIC NO. 45391

KASUYA M
LOCAL WEATHER ANALYSIS OF TOKYO AND THE VICINITY PHOTOCHEMICAL SMOGS.
*24814 APTIC NO. 45639
GENERAL WEATHER CONDITIONS FOR THE FORMATION OF PHOTOCHEMICAL SMOGS IN TOKYO AND THE VICINITY.
*24815 APTIC NO. 45670

KAWAGUCHI T
OXYGEN BLAST FURNACE EMISSION GAS CONTROL METHOD.
24649 APTIC NO. 45397

KAWAI K
THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS. (NO. 3).
24932 APTIC NO. 45683

KAWAI R
ELECTROSTATIC PRECIPITATOR.
24634 APTIC NO. 45672

KAWAMURA T
AIR POLLUTION CAUSED BY PHOTOCHEMICAL REACTION AND METEOROLOGICAL CONDITIONS.
*24816 APTIC NO. 46369
LOCAL WEATHER ANALYSIS OF TOKYO AND THE VICINITY PHOTOCHEMICAL SMOGS.
24814 APTIC NO. 45639
GENERAL WEATHER CONDITIONS FOR THE FORMATION OF PHOTOCHEMICAL SMOGS IN TOKYO AND THE VICINITY.
24815 APTIC NO. 45670

KAWAUCHI B
GAS BOILER WITH MANY MERITS.
*24653 APTIC NO. 45423

KAZAKOV YE A
EFFECT OF CO2 ON ADSORPTION OF NITROGEN PEROXIDE BY SILICA GEL FROM DRY NITROSE GAS.
24666 APTIC NO. 46335

KEAIRNS D L
EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
24723 APTIC NO. 45475

KEENEY D R
NITROGEN AND SULFUR IN PRECIPITATION AND SULFUR DIOXIDE IN THE ATMOSPHERE IN WISCONSIN.
24792 APTIC NO. 46074
ATMOSPHERIC CONTRIBUTION OF S AND N IN WISCONSIN.
24972 APTIC NO. 45559

KEY L W
EFFECT OF PUCCINIA GRAMINIS F. SP. TRITICI ON OZONE INJURY IN WHEAT.
24970 APTIC NO. 45615

KHAIRULLOVICK F
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

KHITERER R Z
EFFECT OF CO2 ON ADSORPTION OF NITROGEN PEROXIDE BY SILICA GEL FROM DRY NITROSE GAS.
24666 APTIC NO. 46335

KHOMUTINNIKOV P S
ELECTROSTATIC PRECIPITATION OF DUST IN OPEN-HEARTH FURNACES.
*24730 APTIC NO. 45376

KILLIAN H J
EVALUATION OF POWERTRAINS FOR HYBRID HEAT ENGINE/ELECTRIC VEHICLES.
24570 APTIC NO. 46093

KIRSCH H
EMISSION MEASUREMENTS OF HYDROGEN CHLORIDE IN THE VICINITY OF POTASSIUM PLANTS.
*24793 APTIC NO. 46359

KISELEVA M S
AMMONIA INFRARED SPECTRA IN ATMOSPHERE.
*24794 APTIC NO. 45353

KITO S
PROBLEMS AND COUNTERMEASURES OF POLYVINYL CHLORIDE CONTAIN-

ING REFUSE COMBUSTION TREATMENT.
*24654 APTIC NO. 45441

KLEE O
PCB IN THE WAKE OF DDT.
*24557 APTIC NO. 46111

KLEIN L A
RECENT DEVELOPMENTS IN NITRIC ACID MANUFACTURE.
24594 APTIC NO. 45570

KLEYMENOV V I
INVESTIGATION OF SPONTANEOUS IONIZATION PROCESS IN NITRIC OXIDE BY MEANS OF PHOTOELECTRON SPECTROSCOPY.
*24869 APTIC NO. 45642

KNELSON J H
DISCUSSION OF THE CARBON MONOXIDE STANDARDS FOR THE FEDERAL GERMAN REPUBLIC, PROPOSED BY THE VDI-KOMMISSION REINHALTUNG DER LUFT.
*24922 APTIC NO. 46107
UNITED STATES AIR QUALITY CRITERIA AND AMBIENT STANDARDS FOR CARBON MONOXIDE.
*24995 APTIC NO. 46108

KOBAYASHI H
GAS-FIRING BOILER AS A METHOD OF POLLUTION CONTROL.
*24558 APTIC NO. 45407

KOBAYASHI K
INFORMATION PROCESSING AND PROBLEMS ON THE BIBLIOGRAPHY OF ENVIRONMENTAL POLLUTION.
*25040 APTIC NO. 45655

KOBAYASHI Y
STUDIES ON ODOR EVALUATIONS IN TOKYO.
24556 APTIC NO. 45654

KOCH K H
FLOW STUDIES ON A BUBBLE-COLUMN CASCADE REACTOR WITH UNIDIRECTIONAL FLOW OF GAS AND LIQUID.
24856 APTIC NO. 45675

KOMAROV V S
KINETICS OF BENZENE VAPOR ADSORPTION ON ZEOLITE CONTAINING ALUMINOSILICATE CRACKING CATALYSTS.
24739 APTIC NO. 45415

KONEVA N V
KINETICS OF THE VAPORIZATION OF MERCURY FROM SODIUM HYDROXIDE SOLUTIONS.
24542 APTIC NO. 45427

KORNEYCHUK G P
APPLICATION OF THE MICROCATALYTIC IMPULSE AND ISOTOPE METHODS TO THE STUDY OF THE CARBON MONOXIDE CATALYTIC OXIDATION MECHANISM ON CUPRIC OXIDE.
24635 APTIC NO. 45904

KOSTIN A E
AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES.
24663 APTIC NO. 46132

KOYAMA I
STUDIES ON ODOR EVALUATIONS IN TOKYO.
24556 APTIC NO. 45654

KOZYUKINA J T
DYNAMICS OF TREE DAMAGE DUE TO COKE-CHEMICAL INDUSTRY GASES.
*24973 APTIC NO. 45389

KRAMM D J
SELECTION AND USE OF THE ROTARY LIME KILN AND ITS AUXILIARIES--II.
*24655 APTIC NO. 46200

KRINITZ B
SIMPLE, RAPID DIGESTION TECHNIQUE FOR THE DETERMINATION OF MERCURY IN FISH BY FLAMELESS ATOMIC ABSORPTION.
24957 APTIC NO. 45712

KROTKOV F G
SCIENTIFIC AND TECHNOLOGICAL ADVANCEMENT, ENVIRONMENT AND MAN.
*25020 APTIC NO. 45635

KROUT L
THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE.
24834 APTIC NO. 46236

KUBICKA R
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

KUCHARSKA E
EFFECT OF CADMIUM, LEAD AND ZINC ON THE SURFACE TENSION OF THE MEMBRANE LINING PULMONARY ALVEOLI AND ON PULMONARY SUSCEPTIBILITY CURVE.
24947 APTIC NO. 45370

KUDO A
A METHOD OF DETERMINING AEROSOL PARTICLE SIZE DISTRIBUTION APPLYING BOLTZMANN S LAW.
*24764 APTIC NO. 46187

KURBANOV A S
POLLUTION OF THE AIR WITH CARCINOGENIC SUBSTANCES BY BAKU PETROLEUM REFINERIES.
24798 APTIC NO. 45632

KURODA H
PRACTICAL ANALYSIS OF EFFECT OF EXHAUST GAS RECIRCULATION ON NOX CONTROL.
24676 APTIC NO. 46155

KURTS A L
REACTIONS OF SULFUR TRIOXIDE AND DIOXANE SULFOTRIOXIDE WITH ORGANIC MERCURY COMPOUNDS.
24855 APTIC NO. 45645

KUSUMOTO S
THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

KUTENEV V F
AUTOMOBILE CRANKCASE VENTILATION SYSTEM REQUIREMENTS FOR THE ABATEMENT OF TOXIC EXHAUSTS.
*24656 APTIC NO. 45629

L

LAND J S
ENGINEERING, ECONOMIC, AND POLLUTION CONTROL ASSESSMENT OF THE MEYERS PROCESS FOR REMOVAL OF PYRITIC SULFUR FROM COAL.
24660 APTIC NO. 45811

LANG B
LOW ENERGY ELECTRON DIFFRACTION STUDIES OF CHEMISORBED GASES ON STEPPED SURFACES OF PLATINUM.
*24870 APTIC NO. 45456

LASSERRE P
THE FIGHT AGAINST ATMOSPHERIC POLLUTION BY FURNACES.
*24731 APTIC NO. 45478

LAVROV N V
PREPARATION OF REDUCING GAS WITH HIGH HYDROGEN CONTENT BY THE PYROLYSIS OF NATURAL METHANE IN MELTS.
*24559 APTIC NO. 45387

LAWALL T R
NITROGEN OXIDE EMISSIONS FROM A FLUIDIZED BED REACTOR.
*24657 APTIC NO. 46221

LAWRENCE E N
LARGE AIR-TEMPERATURE LAPSE-RATES NEAR THE GROUND.
*24871 APTIC NO. 45403

LAWSON J R
INCINERATION OF INDUSTRIAL WASTES.
24544 APTIC NO. 45576

LEAHEY D M
A MODEL FOR CALCULATING THE DEPTH OF THE MIXING LAYER OVER THE URBAN HEAT ISLAND.
*24849 APTIC NO. 45586

LEDERMAN S
MEASUREMENT OF NO CONCENTRATION IN WATER SATURATED NITROGEN.
*24765 APTIC NO. 46258

LEE J

COMPARISON OF THE ABSOLUTE QUANTUM YIELDS OF THE GAS-PHASE O/NO REACTION AND THE LIQUID-PHASE LUMINOL OXIDATION CHEMILUMINESCENCE INTENSITY STANDARDS.
24860 APTIC NO. 46168

LEE S C

A DIFFERENTIAL METHOD FOR THE PREDICTION OF THE EFFECTS OF ATMOSPHERIC BOUNDARY LAYER TURBULENCE USING THE TURBULENCE KINETIC ENERGY EQUATION.
24842 APTIC NO. 45375

THE EFFECT OF TURBULENCE INTENSITY ON DROPLET SUSPENSION IN AN ATMOSPHERIC WINDTUNNEL.
24911 APTIC NO. 45377

LELYUK V P

PHASE CONVERSION OF TARRY PRODUCTS OCCURRING IN GASES EMITTED BY ALUMINUM ELECTROLYSIS WORKSHOPS.
*24560 APTIC NO. 45420

LEMOINE A

BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

LEMOINE P

THE WAR ON POLLUTION. DESULPHURIZATION OF FUELS AND FUEL GASES.
*24658 APTIC NO. 46311

LENSVELT M W

THE CONTRIBUTION OF INDUSTRY TO ENVIRONMENTAL POLLUTION CONTROL.
24729 APTIC NO. 45577

LESTER P

DISTRIBUTION OF HEAVY METALS IN THE VICINITY OF AN INDUSTRIAL COMPLEX.
24800 APTIC NO. 45750

LEUTERT G

THE SPATIAL DEVELOPMENT OF ELECTRIC FIELDS AND SPACE CHARGE DENSITY IN PLATE ELECTROSTATIC PRECIPITATORS.
*24659 APTIC NO. 45679

LEVKOV YE G

PHASE CONVERSION OF TARRY PRODUCTS OCCURRING IN GASES EMITTED BY ALUMINUM ELECTROLYSIS WORKSHOPS.
24560 APTIC NO. 45420

LIIV R

INVESTIGATION OF THE LA/AC COLORIMETRIC METHOD FOR THE DETERMINATION OF AIRBORNE FLUORIDES.
24767 APTIC NO. 45802

LIMAYE D R

QUANTITATIVE MODELS IN THE ENERGY SECTOR - A REVIEW OF THE STATE OF THE ART.
*24561 APTIC NO. 45610

LIN Y K

COMPRESSIBILITY, STRENGTHS AND FROST SUSCEPTIBILITY OF COMPACTED FLY ASH.
*24732 APTIC NO. 45607

LINCH A L

CARBON MONOXIDE--EVALUATION OF EXPOSURE POTENTIAL BY PERSONNEL MONITOR SURVEYS.
*24787 APTIC NO. 45348

LINCOLN R H

AN ENGINEERING APPROACH TO SOLVING ENVIRONMENTAL PROBLEMS IN CONSUMER PRODUCT INDUSTRIES.
*25021 APTIC NO. 46241

LINDVALL T

MAN AS MEASURING INSTRUMENT.
*24766 APTIC NO. 46172

LISACHENKO A A

THE MECHANISM OF OXYGEN PHOTOACTIVATION OCCURRING DURING ITS ADSORPTION ON ZINC OXIDE SURFACES.
*24872 APTIC NO. 45372

LISSI E

ON THE PRODUCTION OF N2O FROM THE REACTION OF O(1D) WITH N2.
24890 APTIC NO. 45687

LO F C

COLD VAPOR ATOMIC ABSORPTION DETERMINATION OF MERCURY IN COAL.
24906 APTIC NO. 45588

LODGE J P JR

PARTICLE PRODUCTION BY POLYMER PYROLYSIS: MASS SPECTROMETRIC INVESTIGATIONS.
24859 APTIC NO. 45960

LONG R

STUDIES ON POLYCYCLIC AROMATIC HYDROCARBONS IN FLAMES.
*24996 APTIC NO. 46224

LORENZI L JR

ENGINEERING, ECONOMIC, AND POLLUTION CONTROL ASSESSMENT OF THE MEYERS PROCESS FOR REMOVAL OF PYRITIC SULFUR FROM COAL.
*24660 APTIC NO. 45811

LUIGA P

INVESTIGATION OF THE LA/AC COLORIMETRIC METHOD FOR THE DETERMINATION OF AIRBORNE FLUORIDES.
*24767 APTIC NO. 45802

LUKAS W

DETERMINING THE FRACTIONAL SEPARATING EFFICIENCY OF CENTRIFUGAL SEPARATORS AS A FUNCTION OF THE ORIGINAL DUST CONCENTRATION AND THE CYCLONE INLET FLOW RATE.
*24733 APTIC NO. 45470

LUKEY M E

EXHAUST GAS CONVERSION FACTORS.
*24562 APTIC NO. 45858

LUNSFORD J H

INFRARED SPECTROSCOPIC INVESTIGATION OF THE ADSORPTION AND REACTIONS OF SO2 ON MGO.
24887 APTIC NO. 46075

LUPANOV P A

AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES.
24663 APTIC NO. 46132

LUTES J M

NEW UNIT RECOVERS GASOLINE VAPORS.
*24661 APTIC NO. 45709

LUTHER W L JR

THE ECOLOGY OF AN AIR COMPRESSOR.
*24978 APTIC NO. 46131

LYDON D S

DETERMINATION OF MAXIMUM EMISSION RATES TO MEET AIR QUALITY STANDARDS.
24847 APTIC NO. 45383

M

MACHIDA Y

DISCUSSION OF ODOR CONTROL MEASURES AGAINST KRAFT PULP.
*24662 APTIC NO. 45409

MACK D

DETERMINATION OF LEAD IN VEGETABLE AND FRUIT INCLUDING GRAPES BY ATOMIC ABSORPTION SPECTROPHOTOMETRY.
*24962 APTIC NO. 46368

MAKSIMOV N G

EPR STUDY OF THE CONDITION OF COPPER INVOLVED IN THE COPPER-MAGNESIUM OXIDATION CATALYST.
*24873 APTIC NO. 45371

MALBOSC R

BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

MALLON H J

PROPOSED EXPERIMENTAL PROGRAMS FOR TESTING REMOTE SENSING APPLICATIONS IN THE METROPOLITAN WASHINGTON AREA. (FINAL REPORT).
*24768 APTIC NO. 46277

MALOV D I
AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES.
*24663 APTIC NO. 46132

MALYAROVA L K
DETERMINATION OF AROMATIC COMPOUNDS (BENZENE AND ITS HOMOLOGUES) IN AIR BY MEANS OF GAS-LIQUID CHROMATOGRAPHY.
*24769 APTIC NO. 46122

MAN IN T VELD A J
THE EFFECT OF OZONE ON THE PHYSICAL WORKING CAPACITY OF ATHLETES.
*24923 APTIC NO. 45351

MANN R F
THE KINETICS OF ADSORPTION OF CARBON MONOXIDE ON ALUMINA.
24893 APTIC NO. 45758

MANOS M J
DETERMINATION AND EVALUATION OF URBAN VEHICLE OPERATING PATTERNS.
24575 APTIC NO. 45777

MARSH R K
FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS.
24969 APTIC NO. 45663

MARSHALL J M
A RADIO ACOUSTIC SOUNDING SYSTEM FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC PARAMETERS.
*24850 APTIC NO. 45550

MARSHALL W F
DIESEL EMISSIONS AS RELATED TO ENGINE VARIABLES AND FUEL CHARACTERISTICS.
*24734 APTIC NO. 45476

MARSHEVA V I
THE MECHANISM OF CARBON MONOXIDE OXIDATION OCCURRING ON METAL OXIDE SURFACES. I. STUDYING THE GRADUAL PROCESS OF CARBON MONOXIDE OXIDATION ON VANADIUM PENTOXIDE SURFACES.
*24664 APTIC NO. 45373

MARTIN D
DIFFUSION DEPOSITION OF SMALL-SIZED PARTICLES IN THE BRONCHIAL TREE.
*24924 APTIC NO. 45360

MARTIN S W
ORGANIC DUSTS, SULFUR DIOXIDE, AND THE RESPIRATORY TRACT OF SWINE.
*24925 APTIC NO. 46158

MASHKOVA G B
USE OF SURFACE OBSERVATIONS FOR CHARACTERIZING THE STATE OF THE SURFACE ATMOSPHERIC LAYER.
*24817 APTIC NO. 46017

MATHE P
THE FEDERAL LAW DRAFT FOR PROTECTION AGAINST AIR POLLUTION AS A CONTRIBUTION TO PROTECTION OF LIFE AND TO PREVENT DESTRUCTION OF THE ENVIRONMENT AND ENVIRONMENTAL RISKS.
*25022 APTIC NO. 46361

MATSON W R
MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE.
24536 APTIC NO. 46097

MATSUMURA I
MICROANALYSIS OF ODOR COMPENENTS FOR ODOR POLLUTION CONTROL.
*24770 APTIC NO. 45772

MATTERSDORF E
REMOTE HEAT SUPPLY ON THE BASIS OF GAS BY REMOTE HEATING PLANTS OR HEATING CENTERS FROM THE OPERATIONAL POINT OF VIEW.
*24665 APTIC NO. 45644

MCARRAGHER J S
SOOT FORMATION AT HIGH PRESSURES: A LITERATURE REVIEW.
*24874 APTIC NO. 45735

MCBRIDE D D
CONDENSED ZINC PARTICLE SIZE DETERMINED BY A TIME DISCRETE SAMPLING APPARATUS.
*24875 APTIC NO. 46167

MCCARROLL J
ATMOSPHERIC POLLUTANTS AND THE PATHOGENESIS OF VIRAL RESPIRATORY INFECTION. SULFUR DIOXIDE AND INFLUENZA INFECTION IN MICE.
24916 APTIC NO. 46157

MCCONNELL J C
ATMOSPHERIC CH4, CO, AND CO2.
24838 APTIC NO. 46156

MCDONALD J
A NEW MODE OF SULFUR DIOXIDE ATTACHMENT TO HALOGENATED TRANSITION METAL COMPLEXES.
24892 APTIC NO. 45648

MCELROY M B
ATMOSPHERIC CH4, CO, AND CO2.
24838 APTIC NO. 46156

MCINTYRE R G
AN INFRA-RED SPECTROSCOPIC VIEW OF ATMOSPHERIC PARTICULATES OVER EL PASO, TEXAS.
24790 APTIC NO. 45756

MCKENZIE H I
THE ANALYSIS OF RESPIRATORY INCAPACITY IN COAL MINE WORKERS OF NEW SOUTH WALES.
24946 APTIC NO. 45362

MCLIN J
STEPPING ACROSS BOUNDARIES.
*25023 APTIC NO. 46124

MCWILLIAMS J K
DUST CONTROL AT OHIO VALLEY.
*24735 APTIC NO. 45584

MEEROVSKAYA V I
EFFECT OF CO2 ON ADSORPTION OF NITROGEN PEROXIDE BY SILICA GEL FROM DRY NITROSE GAS.
*24666 APTIC NO. 46335

MEL NIK V F
HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES.
24563 APTIC NO. 46308

MENKOVSKIY M A
HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES.
*24563 APTIC NO. 46308

MEYERS R A
ENGINEERING, ECONOMIC, AND POLLUTION CONTROL ASSESSMENT OF THE MEYERS PROCESS FOR REMOVAL OF PYRITIC SULFUR FROM COAL.
24660 APTIC NO. 45811

MICHEL G
BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

MIKSCHE G E
REACTIONS OF SULPHUR DURING SULPHATE PULPING.
24540 APTIC NO. 45439

MILLER P R
OXIDANT-INDUCED COMMUNITY CHANGE IN A MIXED CONIFER FOREST.
*24974 APTIC NO. 45617

MILLIKEN F R
COAL AND ENERGY SUFFICIENCY.
*24564 APTIC NO. 46129

MINGLE J O
ORDER-OF-SCATTERING THEORY FOR TRANSPORT PROCESSES.
*24818 APTIC NO. 45357

MITACHI K
INCINERATION TREATMENT METHOD OF ORGANIC WASTE CONTAINING CHLORINE.
*24667 APTIC NO. 45719

MITCHELL J M JR
THE EFFECT OF ATMOSPHERIC AEROSOLS ON CLIMATE WITH SPECIAL REFERENCE TO TEMPERATURE NEAR THE EARTH S SURFACE.
*24851 APTIC NO. 45462

MITSCH G L
THE ELECTROSTATIC PRECIPITATOR AND THE CUPOLA -- 1971.
*24736 APTIC NO. 45364

MITYUSHKIN V G
MODIFICATION OF THE COKE GAS PURIFICATION ELECTRICAL FILTER DESIGN.
*24668 APTIC NO. 45658

MIZUNO K
DIFFUSION EXPERIMENTS IN A WIND TUNNEL.
*24876 APTIC NO. 45680

MOILANEN K
VAPOR-PHASE PHOTODECOMPOSITION OF PESTICIDES.
*24877 APTIC NO. 46059

MOIN F B
PHOTOLYSIS OF THE TRIFLUOROACETIC ACID ANHYDRIDE.
24858 APTIC NO. 45374

MONGAN T R
FEDERAL AIR QUALITY DATA COLLECTION IN THE UNITED STATES.
*24795 APTIC NO. 45595

MONTGOMERY T L
ATMOSPHERIC CHEMICAL INTERACTIONS IN COAL-FIRED POWER PLANT PLUMES.
24809 APTIC NO. 46096

MOORE J F
DELEADING CAN HAVE ANTITRUST IMPLICATIONS.
*25024 APTIC NO. 45452

MORGAN J M
NORMAL LEAD AND CADMIUM CONTENT OF THE HUMAN KIDNEY.
*24926 APTIC NO. 45385

MORITA T
THE WASTE GAS DESULFURIZATION BY KUREHA SYSTEM.
*24669 APTIC NO. 45394

MOROZOV K A
THE FUEL LAYER OCCURRING IN THE CARBURETOR INLET PIPE.
24535 APTIC NO. 45418

MOSHKOVICH A B
AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES.
24663 APTIC NO. 46132

MUELLER D
POSSIBILITIES OF OCCUPATIONAL DAMAGE OF THE MUCOUS TISSUE OF THE UPPER RESPIRATORY TRACT WITH SPECIAL REGARD OF MECHANICAL IRRITATION.
*24927 APTIC NO. 46373

MUKAI K
INFLUENCE OF ENGINE DESIGN FACTORS ON EXHAUST EMISSIONS FROM AUTOMOTIVE GASOLINE ENGINE.
24685 APTIC NO. 46175

MUKAI S
TREATMENT OF COMBUSTION GAS FROM POLYVINYL CHLORIDE AND TIRES.
24641 APTIC NO. 45694

MUKHLENOV I P
HYDROGEN SULFIDE CONVERSION ON PALLADIUM CATALYST.
*24670 APTIC NO. 45641

MUKOSEY V I
OPTIMIZATION OF CARBON MONOXIDE CONVERSION REACTOR DESIGN.
24682 APTIC NO. 45417

MUMFORD R G
UPDATING INCINERATORS TO MEET CURRENT CRITERIA.
24628 APTIC NO. 45365

MURAI S
ENFORCEMENT OF BAD ODOR CONTROL LAW.
*25025 APTIC NO. 45630

MURANUSHI S
VENTURI SCURBBER FOR HIGH TEMPERATURE CORROSIVE GAS.
24640 APTIC NO. 45627

MUSKIE E S
THE GLOBAL ENVIRONMENTAL CRISIS.
*25026 APTIC NO. 45440

N

NACCACHE C
ESR AND IR STUDIES ON THE ADSORPTION AND DISPROPORTIONATION OF NITRIC OXIDE ON COPPER EXCHANGED Y ZEOLITES, AND OF REDUCTION BY CARBON MONOXIDE.
*24997 APTIC NO. 46064

NAGATA K
A CONTROL PLAN FOR NOX EXHAUSTED FROM BOILER PLANTS.
*24671 APTIC NO. 45411

NAGEL L L
A TOTAL CONCEPT SYSTEM FOR MUNICIPAL WASTE DISPOSAL.
*24565 APTIC NO. 45805

NAKAGAWA K
DUST COLLECTION FOR METAL SILICON MANUFACTURING.
24672 APTIC NO. 46141

NAKAJIMA Y
PRACTICAL ANALYSIS OF EFFECT OF EXHAUST GAS RECIRCULATION ON NOX CONTROL.
24676 APTIC NO. 46155

NAKAKUKI A
COALESCENCE OF SPRAY DROPS IN COMPRESSED ATMOSPHERES.
*24878 APTIC NO. 46161

NAKAMURA T
DUST COLLECTION FOR METAL SILICON MANUFACTURING.
*24672 APTIC NO. 46141

NAKASHIMA Y
THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
*24928 APTIC NO. 46270

NAKATA K
COLLECTION EFFICIENCIES OF AEROSOLS BY FIBROUS PACKED BED UNDER THE INFLUENCE OF GRAVITY.
24633 APTIC NO. 46114
FLOW ANALYSIS OF POROUS FILTER AND PARTICLE INERTIA COLLECTION RATE.
*24879 APTIC NO. 46154

NEBEL G J
EFFECTS OF GASOLINE AROMATIC AND LEAD CONTENT ON EXHAUST HYDROCARBON REACTIVITY.
24864 APTIC NO. 46057

NELSON W C
AIR POLLUTION AND SCHOOL ABSENTEEISM IN THREE SOUTHEASTERN CITITES FROM OCTOBER 1969 TO MARCH 1970.
24919 APTIC NO. 45879

NELSON W L
STATUS OF RESIDUAL DESULFURIZATION.
*24673 APTIC NO. 45451

NESTEROVA N YE
DETERMINATION OF AROMATIC COMPOUNDS (BENZENE AND ITS HOMOLOGUES) IN AIR BY MEANS OF GAS-LIQUID CHROMATOGRAPHY.
24769 APTIC NO. 46122

NEWBY R A
EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
24723 APTIC NO. 45475

NEWMAN D J
RECENT DEVELOPMENTS IN NITRIC ACID MANUFACTURE.
*24594 APTIC NO. 45570

NICHOLS R A
NEW UNIT RECOVERS GASOLINE VAPORS.
24661 APTIC NO. 45709

NICKLESS G
DISTRIBUTION OF HEAVY METALS IN THE VICINITY OF AN INDUSTRIAL COMPLEX.
24800 APTIC NO. 45750

NIEUWENHUIZEN J K
INCINERATION OF GASEOUS AND LIQUID WASTES.
*24674 APTIC NO. 46381

NIKI H
ANALYSIS OF OZONE AND NITRIC OXIDE BY A CHEMILUMINESCENT METHOD IN LABORATORY AND ATMOSPHERIC STUDIES OF PHOTOCHEMICAL SMOG.
24779 APTIC NO. 46080

NISHIKAWA M
RECOVERY OF INCOMPLETE COMBUSTION GAS FROM A CONVERTER.
24720 APTIC NO. 45673

NIVOT R

BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

NORDEN H

PROTECTION AGAINST CORROSION IN HEATING SYSTEMS.
*24566 APTIC NO. 46382

NUCKOLLS J

FUSION POWER.
24717 APTIC NO. 46118

NUNN P

CITIZEN PARTICIPATION IN AIR QUALITY MANAGEMENT.
25035 APTIC NO. 45911

O

OBA A

STUDIES ON DESULFURIZATION OF COKE MIXTURE PELLETS.
24651 APTIC NO. 46115

OBERT M J

ELECTRIC FARM VEHICLES. ARE THEY FEASIBLE? Agr. Eng., 53(8):26-27, Aug. 1972.
24567 APTIC NO. 46177

DYNAMICS OF TREE DAMAGE DUE TO COKE-CHEMICAL INDUSTRY GASES.
24973 APTIC NO. 45389

OGNEVA T A

MICROMETEOROLOGICAL CHARACTERISTICS OF ATMOSPHERIC POLLUTION CONDITIONS.
*24819 APTIC NO. 46011

OHARA T

PRODUCTION OF ACRYLIC ESTER AND ITS ECONOMICS--PROPYLENE OXIDATION PROCESS.
*24675 APTIC NO. 46159

OHIGASHI S

PRACTICAL ANALYSIS OF EFFECT OF EXHAUST GAS RECIRCULATION ON NOX CONTROL.
*24676 APTIC NO. 46155

OHIRA T

AIR POLLUTION MEASUREMENT AND DATA HANDLING SYSTEMS.
*25027 APTIC NO. 45490

STUDIES ON ODOR EVALUATIONS IN TOKYO.
24556 APTIC NO. 45654

OKAMOTO K

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

OKI K

THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS. (NO. 3).
24932 APTIC NO. 45683

OKITA T

THE FORMATION MECHANISM OF PAN AND ITS MEASUREMENT METHOD.
*24880 APTIC NO. 46274

OKUYAMA K

THE EFFECT OF MUTUAL INTERFERENCE OF FIBERS IN AN EXPERIMENTAL FIBER PACKED LAYER FILTERING PROCESS.
*24677 APTIC NO. 46165

OLDENKAMP R D

THE MOLTEN CARBONATE PROCESS FOR SULFUR DIOXIDE REMOVAL FROM STACT GASES: PROCESS DESCRIPTION, ECONOMIS, PILOT PLANT DESIGN.
24623 APTIC NO. 46348

OLLE J

BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

OPALKO S

THE CHEMICAL INDUSTRY S STRUGGLE AGAINST ENVIRONMENT POLLUTION - NITROGEN WORKS IN TARNOW AS AN EXAMPLE.
*24678 APTIC NO. 46140

OSIPOV YU S

DIFFUSION FROM A POINT SOURCE OF FINITE TIME OF ACTION.
*24820 APTIC NO. 46016

OSWIN H G

REFUELABLE BATTERIES.
24537 APTIC NO. 45878

OTSU H

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

OTT R

INVESTIGATION OF THE LA/AC COLORIMETRIC METHOD FOR THE DETERMINATION OF AIRBORNE FLUORIDES.
24767 APTIC NO. 45802

OUTHRED K G

THE ANALYSIS OF RESPIRATORY INCAPACITY IN COAL MINE WORKERS OF NEW SOUTH WALES.
24946 APTIC NO. 45362

OVRUTSKIY M I

KINETICS OF THE VAPORIZATION OF MERCURY FROM SODIUM HYDROXIDE SOLUTIONS.
24542 APTIC NO. 45427

OYANGUREN H

PREVALENCE OF CHRONIC BRONCHITIS IN URBAN AND RURAL AREAS OF SANTIAGO AND ITS RELATION WITH AIR POLLUTION INDEXES.
*24929 APTIC NO. 45599

P

PAINE D A

A MACROSCALE - MESOSCALE NUMERICAL MODEL OF INTENSE BAROCLINIC DEVELOPMENT.
24813 APTIC NO. 45391

PARASKEVOPOULOS G

RELATIVE RATE OF REACTION OF O(1D2) WITH N2O.
*24881 APTIC NO. 45386

PARCZEWSKI W

FIELD STUDIES OF AIR POLLUTION IN THE AREA OF THE SKAWINA ELECTRIC POWER PLANT.
*24821 APTIC NO. 46020

PARIENTE R

A STUDY OF PULMONARY DUST DEPOSITS USING THE ELECTRON MICROSCOPE IN CONJUNCTION WITH THE ELECTRON SOUND ANALYSER.
*24930 APTIC NO. 46150

PARK K Y

AN EXTENSION OF THE SIMPLE MATHEMATICAL MODEL BY GIFFORD AND HANNA FOR THE ESTIMATION OF URBAN AIR POLLUTION.
*24822 APTIC NO. 45940

PARKIN D W

PARTICULATE MATTER IN ANTARCTIC SNOW.
*24823 APTIC NO. 45844

PARR J F

VOLATILIZATION OF DIELDRIN FROM FALLOW SOIL AS AFFECTED BY DIFFERENT SOIL WATER REGIMES.
24585 APTIC NO. 46188

PASQUILL F

EFFECTS OF BUILDINGS ON THE LOCAL WIND. WIND STRUCTURE IN THE ATMOSPHERIC BOUNDARY LAYER. III.
*24852 APTIC NO. 45500

PASTERNAK N I

ON THE CONCENTRATIONS OF ALLERGENIC POLLENS AND MOLDS IN THE ATMOSPHERE.
*24796 APTIC NO. 45661

PAULES P E

PRACTICAL APPLICATION OF A FAST RESPONSE CONTINUOUS BOILER FLUE GAS MONITORING SYSTEM.
*24771 APTIC NO. 46098

PAVLOV A V

INFORMATION IN THE SERVICE OF ENVIRONMENTAL PROTECTION AND SANITATION MEASURES.
*25028 APTIC NO. 45378

PAZ S

PREVALENCE OF CHRONIC BRONCHITIS IN URBAN AND RURAL

AREAS OF SANTIAGO AND ITS RELATION WITH AIR POLLUTION INDEXES.
24929 APTIC NO. 45599

PEHRZON L
LEAD IN GASOLINE.
*24679 APTIC NO. 46267

PELLEGRIN M
BACTERIOLOGICAL AND CHEMICAL AIR POLLUTION STUDIES IN TOULOUSE: SAMPLING METHOD AND FIRST RESULTS.
24791 APTIC NO. 46113

PEPPER D W
THE EFFECT OF TURBULENCE INTENSITY ON DROPLET SUSPENSION IN AN ATMOSPHERIC WINDTUNNEL.
*24911 APTIC NO. 45377

PERANIO A
ELECTRIC POWER AND WATER FOR ISRAEL IN THE 1980 S.
*24568 APTIC NO. 45716

PERDON H
INFORMATION, DOCUMENTATION AND EDUCATION FOR AIR POLLUTION PREVENTION.
*25045 APTIC NO. 45545

PETERSON J E
CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE.
24935 APTIC NO. 45651

PETERSON J T
CLIMATIC ASPECTS OF WASTE HEAT.
*24824 APTIC NO. 45875

PFAFF H V
CARBON MONOXIDE--EVALUATION OF EXPOSURE POTENTIAL BY PERSONNEL MONITOR SURVEYS.
24787 APTIC NO. 45348

PHILLIPS D R
PARTICULATE MATTER IN ANTARCTIC SNOW.
24823 APTIC NO. 45844

PHILLIPS D T
SINGLE-PARTICLE LIGHT-SCATTERING MEASUREMENT: PHOTOCHEMICAL AEROSOLS AND ATMOSPHERIC PARTICULATES.
*24825 APTIC NO. 46069

PLATT M
ASSESSING THE IMPACT OF AIRCRAFT EMISSIONS UPON AIR QUALITY.
*24569 APTIC NO. 45860

PLUMMER P L M
MOLECULAR MODEL FOR PRENUCLEATION WATER CLUSTERS.
*24826 APTIC NO. 45689

PODSEVALOV V V
AUTOMATIC CONTROL OF A COMBUSTION FURNACE FOR ORGANIC WASTES.
24663 APTIC NO. 46132

POETSCHKE H
AIR MONITORING AND AIR CLEANING.
*24772 APTIC NO. 46360

POLYDOROVA M
AUTOMATIC UNIT FOR DETERMINATION OF THE AEROSOL CONCENTRATION.
*24773 APTIC NO. 46353

PONGRACE O W
THE TOTAL SYSTEMS TECHNIQUE: UNEMOTIONAL AMMUNITION TO WIN ENVIRONMENTAL POLLUTION WAR.
*25029 APTIC NO. 45367

PONOMAREV YU L
SULFUR DIOXIDE ABSORPTION KINETICS IN ALKALINE SOLUTIONS UNDER FOAMING CONDITIONS.
24703 APTIC NO. 45643

POPELYK L V
HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES.
24563 APTIC NO. 46308

PORTSCHT R
CALCULATION AND MEASUREMENT OF EXTINCTION PROPERTIES OF SMOKE IN THE OPTICAL SPECTRAL RANGE.
*24882 APTIC NO. 45676

PORWIK F
EFFECT OF CADMIUM, LEAD AND ZINC ON THE SURFACE TENSION OF THE MEMBRANE LINING PULMONARY ALVEOLI AND ON PULMONARY SUSCEPTIBILITY CURVE.
*24947 APTIC NO. 45370

POTTER B H
COMMERCIAL EXPERIENCE WITH AN SO2 RECOVERY PROCESS.
*24680 APTIC NO. 46151

POZLOVSKIY A I
QUASI-RADICAL REACTIONS OF NITROGEN OXIDES.
*24883 APTIC NO. 45708

PRICE M A
REACTION OF PEROXYACETYL NITRATE WITH NITRIC OXIDE.
24888 APTIC NO. 45605

PRICE S J W
PROBLEMS IN STACK SAMPLING: PART II--TAKING THE FIRST STEPS.
24755 APTIC NO. 45445

PRIETO L
PREVALENCE OF CHRONIC BRONCHITIS IN URBAN AND RURAL AREAS OF SANTIAGO AND ITS RELATION WITH AIR POLLUTION INDEXES.
24929 APTIC NO. 45599

PUNJRATH J S
INFLUENCE OF AIR TURBULENCE ON RE-ENTRAINMENT OF SMALL PARTICLES FROM FLAT SURFACES.
*24884 APTIC NO. 45746

PYLDRA A P
MN TYPE GAS ANALYZER ALIGNMENT FOR THE AUTOMATIC CONTROL OF THE AIR REGIME IN OPERATING BOILERS.
*24681 APTIC NO. 45634

R

RAINS D W
EFFECT OF LIME ON LEAD UPTAKE BY FIVE PLANT SPECIES.
24954 APTIC NO. 46073

RAK M V
MN TYPE GAS ANALYZER ALIGNMENT FOR THE AUTOMATIC CONTROL OF THE AIR REGIME IN OPERATING BOILERS.
24681 APTIC NO. 45634

RASKIN A YA
OPTIMIZATION OF CARBON MONOXIDE CONVERSION REACTOR DESIGN.
*24682 APTIC NO. 45417

RASMUSSEN C G
DOPPLER ANEMOMETRY WITH A LASER DETECTOR.
*24885 APTIC NO. 46123

RATHGEBER F
METHODS AND EQUIPMENT FOR THE ELIMINATION OF HARMFUL MISTS AND VAPORS.
*24683 APTIC NO. 45640

RAZUMOVSKIY S D
KINETICS AND MECHANISMS OF THE REACTION OF OZONE WITH AROMATIC HYDROCARBONS.
*24912 APTIC NO. 45611

REBIERE A
LEGISLATION AND REGULATIONS CONCERNING ATMOSPHERIC POLLUTION.
*25041 APTIC NO. 45541

REINERT R A
OZONE INDUCED FOLIAR INJURY IN LETTUCE AND RADISH CULTIVARS.
*24963 APTIC NO. 45865

REIST P C
THE SCANNING ELECTRON MICROSCOPE IN AIR POLLUTION STUDIES.
*24774 APTIC NO. 45346

REPIK A J
SO2 RECOVERY VIA ACTIVATED CARBON.
24624 APTIC NO. 46153

RESPLANDY A
AIR POLLUTION DUE TO SULFUR DERIVATIVES EMITTED DURING PULP MANUFACTURE. II. SULFATE PULPING PROCESSES.
*24684 APTIC NO. 46378

REUTOV O A
REACTIONS OF SULFUR TRIOXIDE AND DIOXANE SULFOTRIOXIDE WITH ORGANIC MERCURY COMPOUNDS.
24855 APTIC NO. 45645

REUTSKIY V A
A NEW METHOD FOR THE COMPUTATION OF CHEMISORPTION PARAMETERS.
24868 APTIC NO. 45352

RHODES M L
THE EFFECT OF CARBON MONOXIDE ON MITOCHONDRIAL RESPIRATORY ENZYMES IN LUNG TISSUE.
*24948 APTIC NO. 45612

ROAN J
ATMOSPHERIC POLLUTANTS AND THE PATHOGENESIS OF VIRAL RESPIRATORY INFECTION. SULFUR DIOXIDE AND INFLUENZA INFECTION IN MICE.
24916 APTIC NO. 46157

ROBERTS J J
EPISODE CONTROL CRITERIA AND STRATEGY FOR CARBON MONOXIDE.
25030 APTIC NO. 45766

RODES C E
POLYMERIC BARRIERS AS INTERFACES IN STACK SAMPLING.
*24775 APTIC NO. 45851

ROETHIG W
THE DETERMINATION OF IRON, ALUMINUM AND TITANIUM IN SILICOTIC AND SILICOTIC-TUBERCULOSE LUNGS.
*24931 APTIC NO. 46371

ROSS L E
THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE.
24834 APTIC NO. 46236

ROSS R M
AN AUTOMATIC MONITOR FOR AIRBORNE PARTICULATES.
*24776 APTIC NO. 45853

ROSSIN A D
EPISODE CONTROL CRITERIA AND STRATEGY FOR CARBON MONOXIDE.
*25030 APTIC NO. 45766

ROTH C
PROGRAMS BUT NO PLANS. THE IDEA OF PLANNING AS SHOWN ON THE EXAMPLE OF ENVIRONMENTAL PROBLEMS.
*25031 APTIC NO. 46386

ROWLAND R
MICRODETERMINATION OF SULFUR BY THE RING-OVEN TECHNIQUE.
*24777 APTIC NO. 45649

RUBENSTEIN F D
A BEHAVIORAL STUDY OF POLLUTION: THE ROLE OF PERCEIVED INSTRUMENTALITY IN AN EXTERNALITY SITUATION.
*25047 APTIC NO. 45569

RUBSKAYA G M
A NEW METHOD FOR THE COMPUTATION OF CHEMISORPTION PARAMETERS.
24868 APTIC NO. 45352

RUSHTON J D
POLLUTION CONTROL SPENDING: MANY MILLS WILL NEED TO MAKE DEALS.
*24986 APTIC NO. 46063

RYABOV A V
DESIGNING PNEUMATIC CONVEYING SYSTEMS FOR METAL SHAVINGS AND DUST.
*24737 APTIC NO. 45562

RYDER E J
SELECTION AND BREEDING OF PLANTS FOR INCREASED RESISTANCE TO AIR POLLUTANTS.
*24975 APTIC NO. 45533

S

SABADASH J S
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

SACCO A M
MERCURY BALANCE ON A LARGE PULVERIZED COAL-FIRED FURNACE.
24536 APTIC NO. 46097

SAKABE H
THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS. (NO. 3).
*24932 APTIC NO. 45683

SAKAGUCHI T
A METHOD OF SEPARATING AND CONDENSING SULFUR DIOXIDE BY A POLYVINYL CHLORIDE DIAPHRAGM CONTAINING DIOCTYLPHTHALATE.
24687 APTIC NO. 45682

SAKAI Y
INFLUENCE OF ENGINE DESIGN FACTORS ON EXHAUST EMISSIONS FROM AUTOMOTIVE GASOLINE ENGINE.
*24685 APTIC NO. 46175

SAKANISHI J
EQUIPMENT FOR DESULFURIZATION OF FLUE GAS BY WET CALCIUM METHOD.
*24686 APTIC NO. 45412

SALAMA A O
STOCHASTIC CONTROL AND MULTILEVEL COORDINATION MODELS FOR AIR QUALITY MANAGEMENT WITHIN A REGION.
*25042 APTIC NO. 45602

SAMEDOV I G
POLLUTION OF THE AIR WITH CARCINOGENIC SUBSTANCES BY BAKU PETROLEUM REFINERIES.
*24798 APTIC NO. 45632

SAMPSON H T
EVALUATION OF POWERTRAINS FOR HYBRID HEAT ENGINE/ELECTRIC VEHICLES.
*24570 APTIC NO. 46093

SANO H
A METHOD OF SEPARATING AND CONDENSING SULFUR DIOXIDE BY A POLYVINYL CHLORIDE DIAPHRAGM CONTAINING DIOCTYLPHTHALATE.
*24687 APTIC NO. 45682

SANTAMOUR F S JR
PLANTS THAT WILL WITHSTAND POLLUTION AND REDUCE IT.
24955 APTIC NO. 45540

SARANDRIA J L
AIR QUALITY CONTROL UTILIZING PHOTOMICROGRAPHIC TECHNIQUES.
*24778 APTIC NO. 46032

SASTRI M V C
INTERACTION OF HYDROGEN AND CARBON MONOXIDE ON COBALT CATALYSTS. PART I.
24854 APTIC NO. 46171

SATO E
THE COOLING METHOD FOR FERROALLOY OPEN ELECTRIC FURNACE EMISSION GAS.
*24688 APTIC NO. 45429

SAUDA A
THE TOXICITY OF EMISSIONS FROM HEATED REFRACTORY HIGH POLYMER COMPOUNDS. (NO. 3).
24932 APTIC NO. 45683

SAUTTER W
TESTING ANODIZED ALUMINUM IN ACCELERATED AND NATURAL WEATHERING TESTS.
*24979 APTIC NO. 46358

SAVAGE J D
THE CONTRIBUTION OF FUTURE VEHICLE POWER UNITS TO THE REDUCTION OF AIR POLLUTION.
*24571 APTIC NO. 46121

SCHAEFER H
POWER CONSUMPTION AND ENVIRONMENT.
*24572 APTIC NO. 45633

SCHENKEL W
THE PROBLEM OF INDUSTRIAL WASTE DISPOSAL.
*25032 APTIC NO. 46372

SCHICHT H H
FUNDAMENTALS AND APPLICATION OF CLEAN ROOM TECHNOLOGY.
*24689 APTIC NO. 46384

SCHIFF H I
LABORATORY MEASUREMENTS OF REACTIONS RELATED TO OZONE PHOTOCHEMISTRY.
*24886 APTIC NO. 45547

SCHLESINGER R E

A NUMERICAL MODEL OF DEEP MOIST CONVECTION: THE INFLUENCE OF AMBIENT CONDITIONS AND INTERNAL PHYSICAL MECHANISMS.
*24827 APTIC NO. 45349

SCHOEPPEL R J

PROSPECTS FOR HYDROGEN FUELED VEHICLES.
*24573 APTIC NO. 45935

SCHOONHEYDT R A

INFRARED SPECTROSCOPIC INVESTIGATION OF THE ADSORPTION AND REACTIONS OF SO2 ON MGO.
*24887 APTIC NO. 46075

SCHUCK E A

REACTION OF PEROXYACETYL NITRATE WITH NITRIC OXIDE.
*24888 APTIC NO. 45605

SCHUSTER R

TURNING TURBINES WITH GEOTHERMAL STEAM.
*24574 APTIC NO. 46082

SCHUURMANS C J E

ATMOSPHERIC POLLUTION AFFECTING THE CLIMATE. II.
*24828 APTIC NO. 46383

SCHWAB G M

STUDIES ON EXTENDING THE ACTIVITY OF AN AFTER-BURNER CATALYST.
*24690 APTIC NO. 46356

SCHWARZ R C

SUPERIOR FUEL OIL ADDITIVES CARRY GOOD ENGINEERING CREDENTIALS.
*24691 APTIC NO. 46164

SCOTT W M

DIESEL ENGINE DEVELOPMENT TO AVOID AIR POLLUTION.
*24692 APTIC NO. 46116

SEIDMAN H

THE PHILADELPHIA PULMONARY NEOPLASM RESEARCH PROJECT: BASIC RISK FACTORS OF LUNG CANCER IN OLDER MEN.
24915 APTIC NO. 45752

SELIKOFF I J

CARCINOGENICITY OF AMOSITE ASBESTOS.
*24933 APTIC NO. 46135

SEMENOV A A

THE USE OF DIFFRACTION ANTENNAS IN THE VISUAL RANGE TO STUDY PROPAGATION OF LASER RADIATION IN THE ATMOSPERHE.
*24829 APTIC NO. 45457

SEMIKOV V F

MN TYPE GAS ANALYZER ALIGNMENT FOR THE AUTOMATIC CONTROL OF THE AIR REGIME IN OPERATING BOILERS.
24681 APTIC NO. 45634

SEMKE L K

AIR POLLUTION CONSIDERATIONS IN THE SELECTION OF NEW KRAFT RECOVERY BOILER SYSTEMS.
*24693 APTIC NO. 45744

SEMONIN R G

INTERACTIONS BETWEEN EQUAL-SIZED DROPLETS DUE TO THE WAKE EFFECT.
24908 APTIC NO. 45621

STUDY OF RAINOUT OF RADIOACTIVITY IN ILLINOIS.
*24853 APTIC NO. 45622

SHAH C D

EFFECTS OF GASEOUS DIFFUSION IN THE SUBSTRATE ON LIGHT FASTNESS OF DYES.
24977 APTIC NO. 45473

SHARIFULLIN V N

A NEW METHOD FOR THE COMPUTATION OF CHEMISORPTION PARAMETERS.
24868 APTIC NO. 45352

SHARKO J R

QUANTITATIVE MODELS IN THE ENERGY SECTOR - A REVIEW OF THE STATE OF THE ART.
24561 APTIC NO. 45610

SHERMAN P M

CONDENSED ZINC PARTICLE SIZE DETERMINED BY A TIME DISCRETE SAMPLING APPARATUS.
24875 APTIC NO. 46167

SHIGETA Y

DISCUSSION OF ODOR CONTROL MEASURES AGAINST KRAFT PULP.
24662 APTIC NO. 45409

SHIN H K

TEMPERATURE DEPENDENCE OF VIBRATIONAL TRANSITION PROBABILITIES FOR O2, N2, CO, and CL2 IN THE REGION BELOW 300 K.
*24889 APTIC NO. 46079

SHIPULIN N I

ELECTROSTATIC PRECIPITATION OF DUST IN OPEN-HEARTH FURNACES.
24730 APTIC NO. 45376

SHLYAFIRNER A M

ATMOSPHERIC CORROSION OF LOW-ALLOYED STEELS.
*24980 APTIC NO. 46112

SIEGMUND C W

INFLUENCE OF COMBUSTION MODIFICATION AND FUEL NITROGEN CONTENT ON NITROGEN OXIDES EMISSIONS FROM FUEL OIL COMBUSTION.
24710 APTIC NO. 46265

SIEU H

USE OF FOAM COLUMNS FOR ABSORPTION OF AMMONIA FROM COKE OVEN GAS IN AQUEOUS AMMONIUM DIHYDROGEN PHOSPHATE SOLUTIONS.
*24694 APTIC NO. 45688

SIGSBY J E

A TOTAL CHEMILUMINESCENT METHOD FOR NO AND NOX (NO + NO2) ANALYSIS.
24747 APTIC NO. 45785

SIMONAITIS R

THE REACTION OF OH WITH NO2.
*24891 APTIC NO. 46229

ON THE PRODUCTION OF N2O FROM THE REACTION OF O(1D) WITH N2.
*24890 APTIC NO. 45687

SINCLAIR R S

EFFECTS OF GASEOUS DIFFUSION IN THE SUBSTRATE ON LIGHT FASTNESS OF DYES.
24977 APTIC NO. 45473

SINEL NIKOVA G YE

AMMONIA INFRARED SPECTRA IN ATMOSPHERE.
24794 APTIC NO. 45353

SIROLA J

WHICH ARE THE POSSIBILITIES FOR THE DECREASING OF LEAD IN PETROL.
*25033 APTIC NO. 46190

SLIGER A G

DETAILED COST BREAKDOWN FOR SELECTED SULFUR OXIDE CONTROL PROCESSES. (FINAL REPORT).
24987 APTIC NO. 45890

SLINKIN A A

THE ACTION OF AIR ACTIVATION AND SULFUR DIOXIDE REDUCTION ON THE MAGNETIC PROPERTIES OF ALUMINUM-CHROMIUM CATALYSTS.
24652 APTIC NO. 45721

SMIRNOV V N

REACTIONS OF SULFUR TRIOXIDE AND DIOXANE SULFOTRIOXIDE WITH ORGANIC MERCURY COMPOUNDS.
24855 APTIC NO. 45645

SMITH J W

SPECTROSCOPY BETWEEN 5 AND 6 MICRON WITH A TUNABLE SPIN-FLIP RAMAN SOURCE.
24783 APTIC NO. 45432

SMITH M

DETERMINATION AND EVALUATION OF URBAN VEHICLE OPERATING PATTERNS.
*24575 APTIC NO. 45777

SMITH S

VOLATILIZATION OF DIELDRIN FROM FALLOW SOIL AS AFFECTED BY DIFFERENT SOIL WATER REGIMES.
24585 APTIC NO. 46188

SMITH W A

NOISE CONTROL LEGISLATION.
*25034 APTIC NO. 45590

SMITH W M

EVALUATION OF COKE OVEN EMISSIONS.
*24595 APTIC NO. 45461

SMORGUNOV M P

IMPROVING THE EFFICIENCY OF ASH TRAPPING AND ASH REMOVAL DEVICES DURING EXPLOITATION OF KANSK-ACHINSK COALS.
*24695 APTIC NO. 45631

SNOW M R

A NEW MODE OF SULFUR DIOXIDE ATTACHMENT TO HALOGENATED TRANSITION METAL COMPLEXES.
*24892 APTIC NO. 45648

SNYDER W H

FLUID MODELS FOR THE STUDY OF AIR POLLUTION METEOROLOGY: SIMILARITY CRITERIA, FACILITIES, REVIEW OF LITERATURE, AND RECOMMENDATIONS.
*24830 APTIC NO. 45854

SODERGREN A

CHLORINATED HYDROCARBON RESIDUES IN AIRBORNE FALLOUT.
*24831 APTIC NO. 46083

SOKOLINSKIY YU A

OPTIMIZATION OF CARBON MONOXIDE CONVERSION REACTOR DESIGN.
24682 APTIC NO. 45417

SOKOLOVSKIY V D

THE MECHANISM OF CARBON MONOXIDE OXIDATION OCCURRING ON METAL OXIDE SURFACES. I. STUDYING THE GRADUAL PROCESS OF CARBON MONOXIDE OXIDATION ON VANADIUM PENTOXIDE SURFACES.
24664 APTIC NO. 45373

SOMORJAI G A

LOW ENERGY ELECTRON DIFFRACTION STUDIES OF CHEMISORBED GASES ON STEPPED SURFACES OF PLATINUM.
24870 APTIC NO. 45456

SONODA K

EXHAUST SYSTEM WITH DISINFECTION AND DEODORIZATION FUNCTIONS.
*24696 APTIC NO. 45660

SOTOYAMA T

MEDICAL OBSERVATIONS ON THE HEALTH EFFECTS OF AIR POLLUTANT CAUSED BY PHOTOCHEMICAL REACTION, A GENERAL DISCUSSION.
*24934 APTIC NO. 46269

SPANN L R

FOUNDRY MODERNIZATION REDUCES ACCIDENTS OVER 60%.
*24697 APTIC NO. 46257

SPEDDING D J

SULPHUR DIOXIDE ABSORPTION BY SEA WATER.
*24832 APTIC NO. 46186

SRYVKOV S V

IMPROVING THE EFFICIENCY OF ASH TRAPPING AND ASH REMOVAL DEVICES DURING EXPLOITATION OF KANSK-ACHINSK COALS.
24695 APTIC NO. 45631

ST PIERRE C C

PROBLEMS IN STACK SAMPLING: PART II--TAKING THE FIRST STEPS.
24755 APTIC NO. 45445

STANISLAUS A

THE KINETICS OF ADSORPTION OF CARBON MONOXIDE ON ALUMINA.
*24893 APTIC NO. 45758

STEDMAN D H

ANALYSIS OF OZONE AND NITRIC OXIDE BY A CHEMILUMINESCENT METHOD IN LABORATORY AND ATMOSPHERIC STUDIES OF PHOTOCHEMICAL SMOG.
*24779 APTIC NO. 46080

STEPANOW V

OCEAN AND ATMOSPHERE.
*24833 APTIC NO. 46379

STEPHENS E R

REACTION OF PEROXYACETYL NITRATE WITH NITRIC OXIDE.
24888 APTIC NO. 45605

STEVENS C M

THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE.
*24834 APTIC NO. 46236

STEWART J F

USE OF SPENT STUMPWOOD IN LINERBOARD PRODUCTION.
*24698 APTIC NO. 45740

STEWART R D

CARBOXYHEMOGLOBIN ELEVATION AFTER EXPOSURE TO DICHLOROMETHANE.
*24935 APTIC NO. 45651

STOCKTON E L

CITIZEN PARTICIPATION IN AIR QUALITY MANAGEMENT.
*25035 APTIC NO. 45911

STOROZHILOVA A I

CONDENSATION METHOD OF RECOVERING HIGH-DISPERSIVE FRACTION OF BIOLOGICAL AEROSOLS AND DETERMINATION OF THEIR QUANTITATIVE CONCENTRATION.
24754 APTIC NO. 46152

STREETER R C

A COMBUSTION BOMB METHOD FOR THE DETERMINATION OF MERCURY IN COAL.
*24894 APTIC NO. 45841

STRYKER J L

SO2 RECOVERY VIA ACTIVATED CARBON.
24624 APTIC NO. 46153

STUHL F

ANALYSIS OF OZONE AND NITRIC OXIDE BY A CHEMILUMINESCENT METHOD IN LABORATORY AND ATMOSPHERIC STUDIES OF PHOTOCHEMICAL SMOG.
24779 APTIC NO. 46080

SUGIHARA K

PRACTICAL ANALYSIS OF EFFECT OF EXHAUST GAS RECIRCULATION ON NOX CONTROL.
24676 APTIC NO. 46155

SUGIMOTO N

IMPROVEMENTS ON HEAT MANAGEMENT AT SAGANOSEKI REFINERY.
*24699 APTIC NO. 46125

SUGIURA S

LOCAL WEATHER ANALYSIS OF TOKYO AND THE VICINITY PHOTOCHEMICAL SMOGS.
24814 APTIC NO. 45639

GENERAL WEATHER CONDITIONS FOR THE FORMATION OF PHOTOCHEMICAL SMOGS IN TOKYO AND THE VICINITY.
24815 APTIC NO. 45670

SULLIVAN D A

TWO-PHASE AIR-WATER NOZZLE FLOW.
24900 APTIC NO. 46180

SUTUGIN A G

EFFECT ON NONLAGGING MOLECULAR FORCES ON THE COAGULATION AND CONDENSATION GROWTH OF PARTICLES OF HIGHLY DISPERSED AEROSOLS.
*24913 APTIC NO. 45390

SUZUKI M

ENVIRONMENTAL CONCENTRATION OF TOXIC MATTERS AND INDIVIDUAL EXPOSURE CONCENTRATION.
*24797 APTIC NO. 45718

SUZUKI S

OXIDATION REACTION OF SULFUR DIOXIDE IN THE AIR.
*24895 APTIC NO. 46143

A GENERAL DISCUSSION - AIR POLLUTION FORMATION MECHANISM BY PHOTOCHEMICAL REACTION.
*24896 APTIC NO. 46375

SVIDRNOCH L

SINTER DUST REMOVAL BY DRY AND WET SEPARATORS.
*24738 APTIC NO. 45477

SYMONDS V B

RELATIVE RATE OF REACTION OF O(1D2) WITH N2O.
24881 APTIC NO. 45386

T

TAKAHASHI K

A METHOD OF DETERMINING AEROSOL PARTICLE SIZE DISTRIBUTION APPLYING BOLTZMANN S LAW.
24764 APTIC NO. 46187

TAKANO M

LAW ENFORCEMENT FOR BAD ODOR CONTROL.
*25036 APTIC NO. 45406

TAMORI Y

MEASURING METHODS OF DUST IN STACK GAS.
*24780 APTIC NO. 45771

TAN K J

SOOT FORMATION AT HIGH PRESSURES: A LITERATURE REVIEW.
24874 APTIC NO. 45735

TANAKA E

A SURVEY OF DUST CONTROL AT IRONWORKS.
*24700 APTIC NO. 45358

TANAKA K

A METHOD OF SEPARATING AND CONDENSING SULFUR DIOXIDE BY A POLYVINYL CHLORIDE DIAPHRAGM CONTAINING DIOCTYLPHTHALATE.
24687 APTIC NO. 45682

TANIGUCHI K

TREATMENT METHOD FOR PETROLEUM FUEL COMBUSTION DUSTS.
*24701 APTIC NO. 45395

TANIGUCHI M

POLLUTIONLESS NITRIZATION METHOD NI-TEMPER PROCESS.
*24702 APTIC NO. 46126

TARAT E YA

SULFUR DIOXIDE ABSORPTION KINETICS IN ALKALINE SOLUTIONS UNDER FOAMING CONDITIONS.
*24703 APTIC NO. 45643

TATEISHI R

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

TAUTSUMI S

INFLUENCE OF ENGINE DESIGN FACTORS ON EXHAUST EMISSIONS FROM AUTOMOTIVE GASOLINE ENGINE.
24685 APTIC NO. 46175

TAYLOR R D

AN EFFICIENT HIGH-VOLUME MINIATURE AIR MOVER.
*24781 APTIC NO. 45856

TELLER A J

CONTROL OF EMISSIONS FROM GLASS MANUFACTURE.
*24704 APTIC NO. 45757

TEREBENIN A N

AEROSOL SEDIMENTATION MECHANISMS OCCURRING IN WATER VAPOR DIFFUSION FIELDS.
*24897 APTIC NO. 45713

THOMPSON D

NOX FORMATION IN COMBUSTION.
*24898 APTIC NO. 45754

THOMSEN D E

MHD: HIGH PROMISE, UNSOLVED PROBLEMS.
*24576 APTIC NO. 46185

THORNTON D P

MRG PROCESS FOR SNG.
*24577 APTIC NO. 46166

THRING M W

SOOT IN FLAMES: THE TECHNOLOGICAL SIGNIFICANCE OF THE PROBLEMS OF SOOT AND OTHER PARTICLES FORMED IN FLAMES.
24543 APTIC NO. 45747

THUR G M

THE FEDERAL GOVERNMENT APPROACH TO DEVELOP AUTOMOTIVE GAS TURBINES.
*24578 APTIC NO. 46191

TIEMAN J W

CONTROLLING SO2 EMISSIONS FROM COAL-BURNING BOILERS: A STATUS REPORT.
*24705 APTIC NO. 45759

TIHANSKY D P

POLLUTION CONTROL IN STEEL MAKING: FACT OR FICTION? Rand Corp., Santa Monica, Calif., Rept. P-4552, 6p., Jan. 1971. 10 refs. NTIS: AD 731262
*24596 APTIC NO. 45442

FOLIAR SENSITIVITY OF SOYBEANS TO OZONE AS RELATED TO SEVERAL LEAF PARAMETERS.
*24964 APTIC NO. 45773

OZONE INDUCED FOLIAR INJURY IN LETTUCE AND RADISH CULTIVARS.
24963 APTIC NO. 45865

TISHCHENKO A A

THE USE OF DIFFRACTION ANTENNAS IN THE VISUAL RANGE TO STUDY PROPAGATION OF LASER RADIATION IN THE ATMOSPERHE.
24829 APTIC NO. 45457

TOBIKO T

ELECTROSTATIC PRECIPITATOR.
*24706 APTIC NO. 45434

TODAKA H

PREDICTION OF URBAN SCALE AIR POLLUTION.
24810 APTIC NO. 45402

TOKURA N

INFLUENCE OF ENGINE DESIGN FACTORS ON EXHAUST EMISSIONS FROM AUTOMOTIVE GASOLINE ENGINE.
24685 APTIC NO. 46175

TOMA S Z

DIRECT INFRARED ANALYSIS OF ALPHA QUARTZ DEPOSITED ON FILTERS.
*24782 APTIC NO. 45355

TOMPKINS H G

THE INTERACTION OF NO2 WITH A TIN-LEAD ALLOY.
*24899 APTIC NO. 45733

TOPUNOV V N

AUTOMOBILE CRANKCASE VENTILATION SYSTEM REQUIREMENTS FOR THE ABATEMENT OF TOXIC EXHAUSTS.
24656 APTIC NO. 45629

TORRENCE S L

SO2 RECOVERY VIA ACTIVATED CARBON.
24624 APTIC NO. 46153

TOYAMA T

INDOOR AIR POLLUTION AND ITS EFFECTS ON HUMAN BODY.
*24936 APTIC NO. 45729

TRENKLER H

TWENTY YEARS OF APPLICATION OF THE LD-PROCESS.
*24707 APTIC NO. 45677

TRUHAUT R

DANGERS OF THE CHEMICAL AGE.
*24937 APTIC NO. 46085

TSUJI F

EVEN TREATMENT OF WATER OR AIR BY A CHEMICAL TREATMENT.
*24708 APTIC NO. 45659

TSUNETOSHI Y

CLINICAL OBSERVATIONS OF PHOTOCHEMICAL SMOG INCIDENTS AT TAKASHI JR. HIGH SCHOOL AND OTHER PLACES.
*24938 APTIC NO. 46351

TSUZUKI T

ELECTROSTATIC PRECIPITATOR FOR HIGH PRESSURE GAS.
*24709 APTIC NO. 45413

TUCKER A

CLEAN CUP--MOVE DOWN½ THE TOXIC COCKTAIL.
*24949 APTIC NO. 45647

TURK A

ODOR SOURCE INVENTORIES.
*24579 APTIC NO. 46184

TURNER D B

GRAPHS FOR ESTIMATING MAXIMUM FUMIGATION CONCENTRATIONS.
*24835 APTIC NO. 45798

TURNER D W

INFLUENCE OF COMBUSTION MODIFICATION AND FUEL NITROGEN CONTENT ON NITROGEN OXIDES EMISSIONS FROM FUEL OIL COMBUSTION.
*24710 APTIC NO. 46265

TURREL J D

ELECTRICAL ENERGY: POTENTIALS IN PRODUCTION PROCESSING RECYCLING.
*24580 APTIC NO. 46136

TURUNEN J

SULPHUR IN PINE NEEDLES AND BIRCH LEAVES. PART II. SULPHUR CONTENTS AROUND A PULP MILL.
*24965 APTIC NO. 46105

TUTAEVA N L

KINETICS OF BENZENE VAPOR ADSORPTION ON ZEOLITE CONTAINING ALUMINOSILICATE CRACKING CATALYSTS.
*24739 APTIC NO. 45415

TYSON P D
TEMPERATURE STRUCTURE ABOVE CITIES: REVIEW AND PRELIMINARY FINDINGS FROM THE JOHANNESBURG URBAN HEAT ISLAND PROJECT.
*24836 APTIC NO. 45753

TYUTYUNNIKOV A B
A NEW METHOD FOR THE COMPUTATION OF CHEMISORPTION PARAMETERS.
24868 APTIC NO. 45352

U

UHL W C
NEW QUEBEC REFINERY FEATURES MANY NEW IDEAS.
*24740 APTIC NO. 45384

URATOCHI S
DEODORIZATION DEVICE FOR CHICKEN EXCRETA DRYER.
*24711 APTIC NO. 45347

UTAGAWA M
AIR POLLUTION MEASUREMENT AND DATA HANDLING SYSTEMS.
25027 APTIC NO. 45400

V

VAN BERESTEYN E C H
THE ENHANCEMENT OF ORANGE OIL OXIDATION BY SULPHUR DIOXIDE.
24952 APTIC NO. 46087

VAN KOPPEN C W J
INCINERATION OF GASEOUS AND LIQUID WASTES.
24674 APTIC NO. 46381

VAN LAERHOVEN C
LEAD UPTAKE BY LETTUCE AND OATS AS AFFECTED BY LIME, NITROGEN, AND SOURCES OF LEAD.
24960 APTIC NO. 46071

VAN NICE L J
ENGINEERING, ECONOMIC, AND POLLUTION CONTROL ASSESSMENT OF THE MEYERS PROCESS FOR REMOVAL OF PYRITIC SULFUR FROM COAL.
24660 APTIC NO. 45811

VANDENBULCKE G
PLASTICS AND THE ENVIRONMENT.
*24581 APTIC NO. 46380

VAR YEV V I
MODIFICATION OF THE COKE GAS PURIFICATION ELECTRICAL FILTER DESIGN.
24668 APTIC NO. 45658

VARGAS S
PREVALENCE OF CHRONIC BRONCHITIS IN URBAN AND RURAL AREAS OF SANTIAGO AND ITS RELATION WITH AIR POLLUTION INDEXES.
24929 APTIC NO. 45599

VASIL EVA E V
CHANGES IN THE ANTIGENIC COMPOSITION OF THE LUNGS IN EXPERIMENTAL BERYLLIOSIS.
*24939 APTIC NO. 46006

VEATER T T
LEAD POLLUTION, MOTOR VEHICLES AND HEALTH.
*24940 APTIC NO. 46163

VENTERS A
THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE.
24834 APTIC NO. 46236

VEPREK Y
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

VICK E
CLEAN AIR IS NOT DULL THEORY. A COMMUNICATION ON WASTE GAS CLEANING EQUIPMENT.
*24712 APTIC NO. 46060

VILENSKY V D
RECENT DEPOSITION OF SPHERICAL MICROPARTICLES IN THE SNOW COVER OF THE ANTARCTICA.
*24837 APTIC NO. 45715

VILESOV F I
THE MECHANISM OF OXYGEN PHOTOACTIVATION OCCURRING DURING ITS ADSORPTION ON ZINC OXIDE SURFACES.
24872 APTIC NO. 45372

VISAPAA A
SULPHUR IN PINE NEEDLES AND BIRCH LEAVES. PART II. SULPHUR CONTENTS AROUND A PULP MILL.
24965 APTIC NO. 46105

VISELOV F I
INVESTIGATION OF SPONTANEOUS IONIZATION PROCESS IN NITRIC OXIDE BY MEANS OF PHOTOELECTRON SPECTROSCOPY.
24869 APTIC NO. 45642

VISWANATHAN R B
INTERACTION OF HYDROGEN AND CARBON MONOXIDE ON COBALT CATALYSTS. PART I.
24854 APTIC NO. 46171

VOGEL J A
EFFECT OF CARBON MONOXIDE ON OXYGEN TRANSPORT DURING EXERCISE.
*24941 APTIC NO. 45404

VON VELSEN G W
THE PROBLEM OF INDUSTRIAL WASTE DISPOSAL.
25032 APTIC NO. 46372

VORMS G A
METHOD OF PROCESSING HEAVY SULPHUR-BEARING PETROLEUM RESIDUES INTO LOW-SULPHUR MOTOR AND BOILER PLANT FUELS.
24615 APTIC NO. 45425

W

WAGGONER P E
ROLE OF PLANTS IN IMPROVING THE ENVIRONMENT.
*24966 APTIC NO. 46260

WAGHORNE R H
DESULFURIZATION OF FLUID PETROLEUM COKE.
24616 APTIC NO. 45454

WAGNER A J
MONITORING OPERATION OF A MULTIPLE-COLLECTOR POLLUTION CONTROL INSTALLATION.
*24713 APTIC NO. 45710

WAID D E
THE SWEET SMELL OF SUCCESS IN POLLUTION ABATEMENT PROGRAMS.
*24714 APTIC NO. 46138

WALLER R E
THE COMBINED EFFECTS OF SMOKING AND OCCUPATIONAL OR URBAN FACTORS IN RELATION TO LUNG CANCER.
*24942 APTIC NO. 46134

WALLING D
THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE.
24834 APTIC NO. 46236

WALLIS G B
TWO-PHASE AIR-WATER NOZZLE FLOW.
*24900 APTIC NO. 46180

WALSH L M
NITROGEN AND SULFUR IN PRECIPITATION AND SULFUR DIOXIDE IN THE ATMOSPHERE IN WISCONSIN.
24792 APTIC NO. 46074

EFFECT OF CARRIER, RATE, AND TIME OF APPLICATION OF S ON THE YIELD, AND S AND N CONTENT OF ALFALFA.
24971 APTIC NO. 45558

ATMOSPHERIC CONTRIBUTION OF S AND N IN WISCONSIN.
24972 APTIC NO. 45559

WALTHER J E
EMISSION CONTROL AT THE KRAFT RECOVERY FURNACE.
*24715 APTIC NO. 45763

WAMPLER F B
MECHANISM OF CARBON DIOXIDE FORMATION IN 3130-A IRRADIATED MIXTURES OF SULFUR DIOXIDE AND CARBON MONOXIDE.
*24901 APTIC NO. 45755

WARD D J
MRG PROCESS FOR SNG.
24577 APTIC NO. 46166

WASILESWSKI P
USE OF FOAM COLUMNS FOR ABSORPTION OF AMMONIA FROM COKE OVEN GAS IN AQUEOUS AMMONIUM DIHYDROGEN PHOSPHATE SOLUTIONS.
24694 APTIC NO. 45688

WASP T H
DETAILED COST BREAKDOWN FOR SELECTED SULFUR OXIDE CONTROL PROCESSES. (FINAL REPORT).
*24987 APTIC NO. 45890

WATAHIKI K
FILTERING DEVICE.
*24716 APTIC NO. 45625

WEGE P
CITIZEN PARTICIPATION IN AIR QUALITY MANAGEMENT.
25035 APTIC NO. 45911

WEHRAN H J
THE DETERMINATION OF IRON, ALUMINUM AND TITANIUM IN SILICOTIC AND SILICOTIC-TUBERCULOSE LUNGS.
24931 APTIC NO. 46371

WEISS W
THE PHILADELPHIA PULMONARY NEOPLASM RESEARCH PROJECT: BASIC RISK FACTORS OF LUNG CANCER IN OLDER MEN.
24915 APTIC NO. 45752

WEISZ H L
AIR QUALITY CONTROL UTILIZING PHOTOMICROGRAPHIC TECHNIQUES.
24778 APTIC NO. 46032

WELCH L F
LEAD UPTAKE AND CORN GROWTH WITH SOIL-APPLIED LEAD.
24951 APTIC NO. 46072

WENDELL R E
POLLUTION CONTROL STRATEGY EVALUATION OF URBAN TRANSPORTATION SYSTEMS.
*24583 APTIC NO. 46332
ENVIRONMENTAL ASPECTS OF URBAN TRANSPORTATION PLANNING.
*24582 APTIC NO. 45613

WEST N L
AERODYNAMIC FORCE PREDICTIONS.
*24902 APTIC NO. 45745

WEST P W
MICRODETERMINATION OF SULFUR BY THE RING-OVEN TECHNIQUE.
24777 APTIC NO. 45649

WESTENBERG A A
RELATIVE RATE CONSTANTS FOR O + HCO YIELDS OH + CO AND O + HCO YIELDS H + CO2.
*24903 APTIC NO. 45414

WESTON R F
COMPLYING WITH AIR QUALITY STANDARDS.
*24998 APTIC NO. 46054

WHEELER R C
EFFECT OF CARBON MONOXIDE ON REFLEX VASOCONSTRICTION IN MAN.
24920 APTIC NO. 45657

WICKLIFF C
FOLIAR SENSITIVITY OF SOYBEANS TO OZONE AS RELATED TO SEVERAL LEAF PARAMETERS.
24964 APTIC NO. 45773

WILLIAM A
AIR, PRIMORDIAL FACTOR OF THE ENVIRONMENT.
*24976 APTIC NO. 45345

WILLIAMS J C
SIMPLE, RAPID DIGESTION TECHNIQUE FOR THE DETERMINATION OF MERCURY IN FISH BY FLAMELESS ATOMIC ABSORPTION.
24957 APTIC NO. 45712

WILLIAMS J R
MEASUREMENT OF THERMAL RADIATION SCATTERING CHARACTERISTICS OF SUBMICRON REFRACTORY PARTICLES.
24910 APTIC NO. 45636

WILLIAMS L O
THE CLEANING OF AMERICA.
*24584 APTIC NO. 46300

WILLIS G H
VOLATILIZATION OF DIELDRIN FROM FALLOW SOIL AS AFFECTED BY DIFFERENT SOIL WATER REGIMES.
*24585 APTIC NO. 46188

WILLOUGHBY R A
ORGANIC DUSTS, SULFUR DIOXIDE, AND THE RESPIRATORY TRACT OF SWINE.
24925 APTIC NO. 46158

WOFSKY S C
ATMOSPHERIC CH4, CO, AND CO2.
*24838 APTIC NO. 46156

WOOD F A
AIR POLLUTION RESEARCH NEEDS IN FORESTRY.
*24967 APTIC NO. 45557

WOOD J H
FLUORINE LEVELS IN PLANTS OF THE WARRENTON AREA, 1968-1970: CULTIVATED AND NATIVE WOODY AND HERBACEOUS PLANTS PRIOR TO ALUMINUM FACTORY OPERATIONS.
24969 APTIC NO. 45663

WOOD L
FUSION POWER.
*24717 APTIC NO. 46118

WOOD R A
SPECTROSCOPY BETWEEN 5 AND 6 MICRON WITH A TUNABLE SPIN-FLIP RAMAN SOURCE.
*24783 APTIC NO. 45432

WRIGHT E S
A FEASIBILITY ANALYSIS OF A SIMPLE CYCLE GAS TURBINE ENGINE FOR AUTOMOBILES.
*24586 APTIC NO. 46094

WRIGHT R A
THE ELECTROSTATIC PRECIPITATOR AND THE CUPOLA -- 1971.
24736 APTIC NO. 45364

WURSTER W H
EXPERIMENTAL STUDIES OF PHOTOIONIZATION PROCESSES IN AIR.
*24904 APTIC NO. 45727

WYATT P J
SINGLE-PARTICLE LIGHT-SCATTERING MEASUREMENT: PHOTOCHEMICAL AEROSOLS AND ATMOSPHERIC PARTICULATES.
24825 APTIC NO. 46069

WYMAN F P
MEASUREMENT OF CONFLICT BETWEEN ENVIRONMENTAL AND TECHNOLOGICAL VALUES.
*25046 APTIC NO. 45870

Y

YADERA I
ELECTROSTATIC PRECIPITATOR.
*24718 APTIC NO. 45433

YAKUBOVA G P
ATMOSPHERIC CORROSION OF LOW-ALLOYED STEELS.
24980 APTIC NO. 46112

YAMAGUCHI T
A GRASP OF AIR POLLUTANT EMISSION QUANTITY AT THE EMISSION SOURCE -- METHOD AND EXAMPLES OF TOTAL EMISSION CALCULATION.
*24587 APTIC NO. 45691

YAMAKI N
QUESTION AND ANSWER: THE INITIAL FORMATION OF AIR POLLUTION BY PHOTOCHEMICAL REACTION AND ITS MEASUREMENT TECHNIQUE.
*24905 APTIC NO. 46268

YAMASAKI S
VENTURI-TYPE DUST COLLECTOR.
*24719 APTIC NO. 45399
RECOVERY OF INCOMPLETE COMBUSTION GAS FROM A CONVERTER.
*24720 APTIC NO. 45673

YAMATE N
THE MEASUREMENT METHOD FOR AIR POLLUTANTS CREATED BY PHOTOCHEMICAL REACTIONS AND PROBLEMS.
*24784 APTIC NO. 46272

YANAGISAWA S
EXAMINATION OF OXIDANT COMPOSITION AND MEASUREMENT TECHNIQUES.
*24785 APTIC NO. 46376

COMBUSTION TECHNOLOGY AND POLLUTION CONTROL.
*23999 APTIC NO. 45421

YANG W C

EVALUATION OF THE FLUIDIZED BED COMBUSTION PROCESS. VOLUME I. SUMMARY REPORT.
24723 APTIC NO. 45475

YAVORSKIY V T

HYDROGEN SULFIDE LOSSES IN PROCESSING SULFUR ORES.
24563 APTIC NO. 46308

YOKOYAMA E

THE EFFECTS OF O3 ON LUNG FUNCTION.
*24943 APTIC NO. 46271

YOSHIDA R

THE EFFECTS OF NITROGEN OXIDES ON LIVING BODIES - ANIMAL EXPERIMENTS OF NO2 EXPOSURE.
24928 APTIC NO. 46270

YOSHIKAWA R

POLLUTIONLESS NITRIZATION METHOD NI-TEMPER PROCESS.
24702 APTIC NO. 46126

YOSHIMOTO R

THE EFFECT OF MUTUAL INTERFERENCE OF FIBERS IN AN EXPERIMENTAL FIBER PACKED LAYER FILTERING PROCESS.
24677 APTIC NO. 46165

YOSHIOKA N

COLLECTION EFFICIENCIES OF AEROSOLS BY FIBROUS PACKED BED UNDER THE INFLUENCE OF GRAVITY.
24633 APTIC NO. 46114

YOUNG H E

PUCKERBRUSH UTILIZATION FOR PAPER PRODUCTS.
*24721 APTIC NO. 45738

YUR YEVA T M

EPR STUDY OF THE CONDITION OF COPPER INVOLVED IN THE COPPER-MAGNESIUM OXIDATION CATALYST.
24873 APTIC NO. 45371

Z

ZABOROWSKI L M

ONLY YOUR CHEMIST KNOWS FOR SURE: DETERMINATION OF MERCURY IN MAN.
*24944 APTIC NO. 46055

ZADOKS J C

FLYING FUNGI.
*24839 APTIC NO. 45563

ZAIKOV G YE

KINETICS AND MECHANISMS OF THE REACTION OF OZONE WITH AROMATIC HYDROCARBONS.
24912 APTIC NO. 45611

ZASHUKHIN E N

EXPERIMENTAL STUDIES OF ATMOSPHERIC POLLUTION IN INDUSTRIAL AREAS.
24806 APTIC NO. 46019

ZAYTSEV A S

AUTOMATION OF INFORMATION PROCESSING INVOLVED IN EXPERIMENTAL STUDIES OF ATMOSPHERIC DIFFUSION.
*24840 APTIC NO. 46010

ZEEDIJK H

THE EFFECT OF OZONE ON THE PHYSICAL WORKING CAPACITY OF ATHLETES.
24923 APTIC NO. 45351

ZIBOROVA S P

STUDY OF THE INFLUENCE OF IRREGULARITIES OF THE EARTH S SURFACE ON THE AIR FLOW CHARACTERISTICS IN A WIND TUNNEL.
24805 APTIC NO. 46012

ZIRKES A

THE ROLE OF THE COMMERCIAL ANALYTICAL SERVICE IN SOLVING WIRE INDUSTRY AIR AND WATER POLLUTION PROBLEMS.
25014 APTIC NO. 45449

ZRAZHEVSKIY I M

STUDY OF THE INFLUENCE OF IRREGULARITIES OF THE EARTH S SURFACE ON THE AIR FLOW CHARACTERISTICS IN A WIND TUNNEL.
24805 APTIC NO. 46012

ORDER FORM

USE RESTRICTED AS INDICATED IN THE INTRODUCTION

SEND TO:

ENVIRONMENTAL PROTECTION AGENCY
AIR POLLUTION TECHNICAL INFORMATION CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

Date

Name

Program

Address

THIS FORM IS TO BE USED FOR ORDERING MICROFICHE DUPLICATES. INDICATE THE ARTICLES YOU REQUIRE BY CIRCLING THEIR APTIC NUMBERS. IF YOU DO NOT HAVE ACCESS TO A MICROFICHE READER, YOU MAY REQUEST PAPER COPIES. HOWEVER, MICROFICHE CAN USUALLY BE PROVIDED IN ABOUT 1/5 THE TIME REQUIRED TO PROVIDE PAPER COPIES.

45345	45346	45347	45348	45349	45350	45351	45352	45353	45355	45356	45357	45358	45359
45360	45361	45362	45364	45365	45367	45368	45369	45370	45371	45372	45373	45374	45375
45376	45377	45378	45381	45383	45384	45385	45386	45387	45388	45389	45390	45391	45392
45393	45394	45395	45396	45397	45398	45399	45400	45401	45402	45403	45404	45405	45406
45407	45408	45409	45410	45411	45412	45413	45414	45415	45417	45418	45419	45420	45421
45422	45423	45424	45425	45426	45427	45428	45429	45430	45431	45432	45433	45434	45435
45436	45437	45438	45439	45440	45441	45442	45444	45445	45447	45449	45450	45451	45452
45453	45454	45455	45456	45457	45458	45459	45460	45461	45462	45463	45470	45473	45475
45476	45477	45478	45491	45500	45520	45531	45532	45533	45534	45535	45536	45539	45540
45541	45544	45545	45547	45550	45553	45555	45556	45557	45558	45559	45561	45562	45563
45568	45569	45570	45571	45573	45576	45577	45584	45586	45587	45588	45590	45591	45592
45595	45599	45602	45603	45604	45605	45607	45609	45610	45611	45612	45613	45615	45616
45617	45618	45621	45622	45625	45626	45627	45629	45630	45631	45632	45633	45634	45635
45636	45637	45638	45639	45640	45641	45642	45643	45644	45645	45647	45648	45649	45651
45652	45654	45655	45656	45657	45658	45659	45660	45661	45662	45663	45664	45665	45666
45668	45669	45670	45671	45672	45673	45675	45676	45677	45678	45679	45680	45681	45682
45683	45687	45688	45689	45690	45691	45693	45694	45699	45703	45705	45706	45708	45709
45710	45711	45712	45713	45715	45716	45717	45718	45719	45720	45721	45722	45725	45726
45727	45728	45729	45732	45733	45734	45735	45738	45739	45740	45741	45744	45745	45746
45747	45749	45750	45752	45753	45754	45755	45756	45757	45758	45759	45763	45766	45767
45770	45771	45772	45773	45776	45777	45785	45798	45802	45805	45810	45811	45812	45833
45841	45844	45851	45853	45854	45856	45858	45860	45865	45870	45875	45878	45879	45882
45883	45884	45890	45900	45904	45911	45923	45928	45929	45930	45931	45932	45935	45937
45940	45944	45950	45956	45958	45960	45969	46006	46010	46011	46012	46013	46014	46015

46016 46017 46019 46020 46032 46035 46039 46048 46053 46054 46055 46057 46059 46060
46063 46064 46068 46069 46071 46072 46073 46074 46075 46076 46079 46080 46081 46082
46083 46085 46087 46088 46089 46092 46093 46094 46095 46096 46097 46098 46105 46107
46108 46111 46112 46113 46114 46115 46116 46117 46118 46119 46120 46121 46122 46123
46124 46125 46126 46129 46130 46131 46132 46133 46134 46135 46136 46137 46138 46140
46141 46142 46143 46148 46149 46150 46151 46152 46153 46154 46155 46156 46157 46158
46159 46161 46162 46163 46164 46165 46166 46167 46168 46169 46170 46171 46172 46173
46175 46176 46177 46178 46179 46180 46181 46182 46183 46184 46185 46186 46187 46188
46190 46191 46192 46193 46194 46195 46196 46197 46199 46200 46213 46219 46221 46224
46229 46236 46241 46257 46258 46259 46260 46261 46263 46264 46265 46266 46267 46268
46269 46270 46271 46272 46273 46274 46277 46294 46300 46308 46311 46323 46327 46332
46335 46338 46348 46351 46353 46354 46355 46356 46358 46359 46360 46361 46362 46363
46364 46365 46366 46367 46368 46369 46370 46371 46372 46373 46375 46376 46377 46378
46379 46380 46381 46382 46383 46384 46385 46386

ADDRESSES OF PUBLISHERS

All periodicals which are regularly screened for information to be abstracted in the Air Pollution Abstracts are included.

For foreign-language periodicals, U. S. publishers are listed where known. Foreign language periodicals are listed in their original language. All Japanese periodicals are cross-referenced to English titles.

Reproduced from
best available copy.

A.I.A.A. BULLETIN
AMERICAN INSTITUTE OF AERONAUTICS AND
ASTRONAUTICS
1290 AVENUE OF AMERICAS
NEW YORK, N.Y. 10019

A.I.A.A. JOURNAL
AMERICAN INSTITUTE OF AERONAUTICS AND
ASTRONAUTICS
1290 AVENUE OF AMERICAS
NEW YORK, N.Y. 10019

A.I.CH.E. JOURNAL
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

A.P.C.D. DIGEST
AIR POLLUTION CONTROL DISTRICT
COUNTY OF LOS ANGELES
434 S. SAN PEDRO ST.
LOS ANGELES, CALIF. 90013

A.S.H.R.A.E. JOURNAL
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND
AIR-CONDITIONING ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

A.S.H.R.A.E. TRANSACTIONS
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND
AIR-CONDITIONING ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

A.T.Z. = AUTOMOBILTECHNISCHE ZEITSCHRIFT
FRANCKHSCHE VERLAGSHANDLUNG
ABTEILUNG TECHNIK
PFIZERSTR 5-7
7 STUTTGART, GERMANY

ACQUISITIONS MEDICALES RECENTES
EXPANSION SCIENTIFIQUE FRANCAISE
15 RUE SAINT-BENOIT
PARIS 6, FRANCE

ACTA ALLERGOLOGICA
MUNKSGAARD
PRAGS BLVD. 47
2300 COPENHAGEN S, DENMARK

ACTA CHEMICA SCANDINAVICA
MUNKSGAARD
PRAGS BLVD. 47
2300 COPENHAGEN S, DENMARK

ACTA CHIMICA (ACADEMIAE SCIENTIARUM HUNGARICAE)
KULTURA
P.O. BOX 149
BUDAPEST 62, HUNGARY

ACTA DERMATO-VENEREOLOGICA
SVEN HELLERSTROM
KAROLINSKA SJUKHUSET
STOCKHOLM 60, SWEDEN

ACTA GEOPHYSICA POLONICA
RUCH
UL WRONIA 23
WARSAW, POLAND

ACTA MEDICA ET BIOLOGICA (NIIGATA)
NIIGATA DAIGAKU IGAKUBU
ASAHI-CHO
NIIGATA, JAPAN

ACTA MEDICA IUGOSLAVICA
NOLIT PUBLISHING HOUSE
TERAZIJE 27/11
BELGRADE, YUGOSLAVIA
U.S. ADDRESS
CLEARINGHOUSE FOR FEDERAL SCIENTIFIC
AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

ACTA MEDICA SCANDINAVICA
ACTA MEDICA SCANDINAVICA
P.O. BOX 2052
STOCKHOLM 2, SWEDEN

ACTA MICROBIOLOGICA (ACADEMIAE SCIENTIARUM
HUNGARICAE)
PUBLISHING HOUSE OF THE HUNGARIAN
ACADEMY OF SCIENCES
ALKOTMANY U. 21
BUDAPEST, HUNGARY

ACTA NEUROPATHOLOGICA
SPRINGER-VERLAG
HEIDELBERGER PLATZ 3
1000 BERLIN 33 W. GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

ACTA OTO-LARYNGOLOGICA
PROF. PAUL FRENCKNER
16 NARVAVAGEN
STOCKHOLM, SWEDEN

ACTA OTO-RHINO-LARYNGOLOGICA BELGICA
LES PUBLICATIONS
ACTA MEDICA BELGICA
43, RUE DES CHAMPS-ELYSEES
BRUSSELS, BELGIUM

ACTA PATHOLOGICA ET MICROBIOLOGICA SCANDINAVICA
MUNKSGAARD
PRAGS BLVD. 47
2300 COPENHAGEN S, DENMARK

ACTA PHARMACOLOGICA ET TOXICOLOGICA
MUNKSGAARD
PRAGS BLVD. 47
2300 COPENHAGEN S, DENMARK

ACTA PHYSICA AUSTRIACA
SPRINGER-VERLAG
MOELKERBASTEI 5
VIENNA 1, AUSTRIA
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

ACTA PHYSIOLOGICA (ACADEMIAE SCIENTIARUM HUNGARICAE)
PUBLISHING HOUSE OF THE HUNGARIAN
ACADEMY OF SCIENCES
ALKOTMANY 21
BUDAPEST V, HUNGARY

ACTA PHYSIOLOGICA POLONICA (ENGLISH TRANSLATION)
AKADEMIA NAUK
PANSTWOWY ZAKLAD WYDAWNICTW LEKARSKICH
UL. DLUGA 38/40
WARSAW, POLAND
U.S. ADDRESS
CLEARINGHOUSE FOR FEDERAL SCIENTIFIC
AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

ACTA PHYSIOLOGICA SCANDINAVICA
KAROLINSKA INSTITUTET
EDITORIAL OFFICE
STOCKHOLM, SWEDEN

ACTA TECHNICA (ACADEMIAE SCIENTIARUM HUNGARICAE)
AKADEMIAI KIADO
PUBLISHING HOUSE OF THE HUNGARIAN
ACADEMY OF SCIENCES
ALKOTMANY U. 21
BUDAPEST V, HUNGARY

ACTA TUBERCULOSEA ET PNEUMOLOGICA BELGICA
ASSOCIATION DES SOCIETES SCIENTIFIQUES
MEDICALES BELGES
56 RUE DE LA CONCORDE
BRUSSELS, BELGIUM

ACTA UNIVERSITATIS CAROLINAE, MEDICA
CAROLINE UNIVERSITY
MEDICAL FACULTY LIBRARY
CURIEOVYCH 7
PRAGUE 1, CZECHOSLOVAKIA

ADVANCEMENT OF SCIENCE (LONDON)
ACADEMIC PRESS INC. LTD.
BERKELEY SQ. HOUSE, BERKELEY SQ.
LONDON W1, ENGLAND
U.S. ADDRESS
ACDEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

ADVANCES IN APPLIED MICROBIOLOGY
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

ADVANCES IN CANCER RESEARCH
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

ADVANCES IN CARDIOPULMONARY DISEASES
YEARBOOK MEDICAL PUBLISHERS
35 E. WACKER DRIVE
CHICAGO, ILL. 60601

ADVANCES IN INTERNAL MEDICINE
YEARBOOK MEDICAL PUBLISHERS
35 E. WACKER DRIVE
CHICAGO, ILL. 60601

AEROSPACE MEDICINE
AEROSPACE MEDICAL ASSOCIATION
WASHINGTON NATIONAL AIRPORT
WASHINGTON D.C. 20001

AG CHEM
INDUSTRY PUBLICATIONS, INC.
P.O. BOX 31
CALDWELL, N.J. 07006

AGRICULTURAL RESEARCH
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

AGRONOMY JOURNAL
AMERICAN SOCIETY OF AGRONOMY
677 S. SEGOE ROAD
MADISON, WIS. 53711

AIR POLLUTION TITLES
CENTER FOR AIR ENVIRONMENT STUDIES
226 CHEMICAL ENGINEERING II
PENNSYLVANIA STATE UNIVERSITY
UNIVERSITY PARK, PA. 16802

AIR QUALITY CONTROL DIGEST
UNIVERSITY DIGEST SERVICES
P.O. BOX 343
TROY, MICHIGAN 48084

AKUSHERSTVO I GINEKOLOGIYA (OBSTETRICS AND GYNECOLOGY)
V/O ""MEZHDUNARODNAYA KNIGA""
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

AKUSTIC NO KENKYO (OUCH RESEARCH JOURNAL OF JAPAN)
AKUSHU KOGAI KENKYUKAI
NO. 12, 2-BAN, 1-CHOME MUKOGAOKA
BUNKYO-KU, TOKYO, JAPAN

ALERGIA (MEXICO)
MEDELLIN 94-11
MEXICO, D.F., MEXICO

ALLERGIE UND IMMUNOLOGIE
JOHANN AMBROSIUS BARTH VERLAG
SALOMONSTR. 18 B
701 LEIPZIG, GERMANY

ALLGEMEINE FORSTZEITSCHRIFT
BAYERISCHER LANDWIRTSCHAFTSVERLAG GMBH
POSTFACH 299
MUNICH 3, GERMANY

ALLGEMEINE UND PRAKTISCHE CHEMIE
VERLAG U.M. LEITNER
JAKOBERGASSE 4
VIENNA 1, AUSTRIA

ALUMINIUM (DUESSELDORF)
ALUMINIUM-VERLAG GMBH.
JAGERHOFSTR. 29
4 DUESSELDORF, GERMANY

AMERICAN CERAMIC SOCIETY BULLETIN
AMERICAN CERAMIC SOCIETY
4055 N. HIGH STREET
COLUMBUS, OHIO 43214

AMERICAN CITY
BUTTENHEIM PUBLISHING CORPORATION
757 THIRD AVENUE
NEW YORK, N.Y. 10017

AMERICAN DYESTUFF REPORTER
HOWES PUBLISHING COMPANY INC.
44 E. 23RD STREET
NEW YORK, N.Y. 10010

AMERICAN GAS ASSOCIATION MONTHLY
WILLIAM J. NICKEL, ED.
605 THIRD AVENUE
NEW YORK, N.Y. 10016

AMERICAN GAS JOURNAL
PETROLEUM ENGINEER PUBLISHING COMPANY
DAVIS BUILDING
P.O. BOX 1589
DALLAS, TEX. 75221

AMERICAN HEART JOURNAL
C.V. MOSBY COMPANY
3207 WASHINGTON BLVD.
ST. LOUIS, MO. 63103

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION JOURNAL
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION
14125 PREVOST
DETROIT, MICH. 48227

AMERICAN JOURNAL OF BOTANY
THE CITY COLLEGE
CONVENT AVENUE
NEW YORK, N.Y. 10031

AMERICAN JOURNAL OF CARDIOLOGY
REUBEN H. DONNELLEY CORPORATION
466 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

AMERICAN JOURNAL OF CLINICAL PATHOLOGY
WILLIAMS AND WILKINS CO.
428 E. PRESTON STREET
BALTIMORE, MD. 21202

AMERICAN JOURNAL OF EPIDEMIOLOGY
WILLIAMS AND WILKINS CO.
428 E. PRESTON STREET
BALTIMORE, MD. 21202

AMERICAN JOURNAL OF THE MEDICAL SCIENCES
LEA AND FEBIGER
600 S. WASHINGTON SQUARE
PHILADELPHIA, PA. 19106

AMERICAN JOURNAL OF MEDICINE
REUBEN H. DONNELLEY CORPORATION
466 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

AMERICAN JOURNAL OF NURSING
AMERICAN JOURNAL OF NURSING COMPANY
10 COLUMBUS CIRCLE
NEW YORK, N.Y. 10019

AMERICAN JOURNAL OF PATHOLOGY
HARPER AND ROW, PUBLISHERS, INC.
HOEBER MEDICAL DIVISION
49 E. 33RD STREET
NEW YORK, N.Y. 10016

AMERICAN JOURNAL OF PHYSICS
AMERICAN INSTITUTE OF PHYSICS, INC.
335 E. 45TH STREET
NEW YORK, N.Y. 10017

AMERICAN JOURNAL OF PHYSIOLOGY
AMERICAN PHYSIOLOGICAL SOCIETY
9650 ROCKVILLE PIKE
BETHESDA, MD. 20014

AMERICAN JOURNAL OF PUBLIC HEALTH AND THE NATION'S HEALTH
AMERICAN PUBLIC HEALTH ASSOCIATION
1790 BROADWAY
NEW YORK, N.Y. 10019

AMERICAN JOURNAL OF VETERINARY RESEARCH
AMERICAN VETERINARY MEDICAL ASSOCIATION
600 S. MICHIGAN AVENUE
CHICAGO, ILL. 60605

AMERICAN MACHINIST
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 10036

AMERICAN PAINT JOURNAL
AMERICAN PAINT JOURNAL COMPANY
2911 WASHINGTON AVENUE
ST. LOUIS, MO. 63102

AMERICAN PAPER INDUSTRY
PAPER INDUSTRY MANAGEMENT ASSOCIATION
2570 DEVON AVENUE
DES PLAINES, ILL. 60018

AMERICAN REVIEW OF RESPIRATORY DISEASES
NATIONAL TUBERCULOSIS ASSOCIATION
1740 BROADWAY
NEW YORK, N.Y. 10019

AMERICAN SCIENTIST
SIGMA XI
155 WHITNEY AVENUE
NEW HAVEN, CONN. 06510

ANALES DE MEDICINA Y CIRUGIA (BARCELONA)
ACADEMIA DE CIENCIAS MEDICAS
BARCELONA, SPAIN

ANALYST
CHEMICAL SOCIETY
BURLINGTON HOUSE, PICCADILLY
LONDON W1, ENGLAND

ANALYTICA CHIMICA ACTA
ELSEVIER PUBLISHING COMPANY
SPUISTRAAT 110-112
AMSTERDAM, NETHERLANDS
U.S. ADDRESS
AMERICAN ELSEVIER PUBLISHING COMPANY, INC.
52 VANDERBILT AVENUE
NEW YORK, N.Y. 10017

ANALYTICAL ABSTRACTS
MRS. H.I. FISK, ED.
9-10 SAVILE ROW
LONDON WIX IAF, ENGLAND

ANALYTICAL CHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

ANNALES DE BIOLOGIE CLINIQUE
EXPANSION SCIENTIFIQUE FRANCAISE
15 RUE SAINT-BENOIT
PARIS 6E, FRANCE

ANNALES DE GEOPHYSIQUE
EDITIONS DU CENTRE NATIONAL DE LA
RECHERCHE SCIENTIFIQUE
15 QUAI ANATOLE-FRANCE
PARIS 7, FRANCE

ANNALES MEDICINAE EXPERIMENTALIS ET BIOLOGIAE FENNIAE
FINNISH MEDICAL SOCIETY DUODECIM
MIKONKATU 3
HELSINKI, FINLAND

ANNALES DES MINES DE BELGIQUE
EDITIONS TECHNIQUES ET SCIENTIFIQUES
37-41 RUE BORRENS
BRUSSELS 5, BELGIUM

ANNALES SCIENTIFIQUES DE L'UNIVERSITE DE BESANCON. CHIMIE
INST. DES SCIENCES NATURELLAS
PLACE LECLERC
BESANCON, DOUBS, FRANCE

ANNALI DI CHIMICA (ROME)
SOCIETA CHIMICA ITALIANA
VIALE LIEGI, 48
ROME, ITALY

ANNALI DELL'ISTITUTO SUPERIORE DI SANITA (ROME)
ISTITUTO POLIGRAFICO DELLO STATO
LIBRERIA DELLO STATO
PIAZZA VERDI, 10
ROME, ITALY

ANNALI DI MEDICINA NAVALE
ISPETTORATO DI SANITA DELLA
MARINA MILITARE
ROME, ITALY

ANNALI DI RADIOLOGIA DIAGNOSTICA
CASA EDITRICE LICINIO CAPPELLI
VIA FARINI 6
BOLOGNA, ITALY

ANNALI DELLA SANITA PUBBLICA
UFFICIO PUBBLICITA EDIZIONI
UFFICIALI U.P.E.U.
VIA TACITO 10
ROME, ITALY

ANNALI DI STOMATOLOGIA
VIALE REGINA ELENA 287
ROME, ITALY

ANNALS OF ALLERGY
BRUCE PUBLISHING COMPANY
2642 UNIVERSITY AVENUE
ST. PAUL, MINN. 55114

ANNALS OF APPLIED BIOLOGY
CAMBRIDGE UNIVERSITY PRESS
200 EUSTON ROAD
LONDON, N.W.1, ENGLAND
U.S. ADDRESS
CAMBRIDGE UNIVERSITY PRESS
32 E. 57TH STREET
NEW YORK, N.Y. 10022

ANNALS OF INTERNAL MEDICINE
AMERICAN COLLEGE OF PHYSICIANS
4200 PINE STREET
PHILADELPHIA, PA. 19104

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES
NEW YORK ACADEMY OF SCIENCES
2 E. 63RD STREET
NEW YORK, N.Y. 10021

ANNALS OF OCCUPATIONAL HYGIENE
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY
ANNALS PUBLISHING COMPANY
P.O. BOX 11606
CLAYTON STATION
ST. LOUIS, MO. 63105

ANNALS OF THORACIC SURGERY
LITTLE, BROWN AND COMPANY
34 BEACON STREET
BOSTON, MASS. 02106

ANNUAL REVIEW OF MEDICINE
ANNUAL REVIEWS, INC.
231 GRANT STREET
PALO ALTO, CALIF. 94306

Reproduced from
best available copy.

ANNUAL REVIEW OF PHYTOPATHOLOGY
ANNUAL REVIEWS, INC.
231 GRANT STREET
PALO ALTO, CALIF. 94306

ANNUAL REVIEW OF PLANT PHYSIOLOGY
ANNUAL REVIEWS, INC.
231 GRANT STREET
PALO ALTO, CALIF. 94306

ANTRIEBSTECHNIK
KOMMANDITGESELLSCHAFT KRAUSSKOPF-VERLAG
FUER WIRTSCHAFT GMBH
LESSINGSTR. 12-14
65 MAINZ, W. GERMANY

APPLIED MICROBIOLOGY
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

APPLIED OPTICS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

APPLIED SCIENTIFIC RESEARCH
MARTINUS NIJHOFF
LANGE VOORHOUT 9-11
THE HAGUE, NETHERLANDS

APPLIED SPECTROSCOPY
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

ARCHIV FUER METEOROLOGIE, GEOPHYSIK UND
BIOKLIMATOLOGIE
SPRINGER-VERLAG
MOELKERBASTEI 5
VIENNA 1, AUSTRIA
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

ARCHIV FUER OPHTHALMOLOGIE
SPRINGER-VERLAG
HEIDELBERGER PL 3
1 BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

ARCHIV FUER TECHNISCHES MESSEN UND INDUSTRIELLE
MESSTECHNIK (ATM)
R. OLDENBOURG VERLAG
ROSENHEIMER STR. 145
8000 MUNICH 80, GERMANY

ARCHIVES BELGES DE MEDECINE SOCIALE, HYGIENE,
MEDECINE DU TRAVAIL ET MEDECINE LEGALE
A.S.S.M.B. PUBLICATIONS
ACTA MEDICA BELGICA
43 RUE DES CHAMPS-ELYSEES
BRUSSELS 5, BELGIUM

ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS
ACADEMIC PRESS INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

ARCHIVES OF DISEASE IN CHILDHOOD
BRITISH MEDICAL ASSOCIATION
TAVISTOCK SQUARE
LONDON, ENGLAND
U.S. ADDRESS
BRITISH MEDICAL JOURNAL
40 BRIGHTON AVENUE
BOSTON, MASS. 02134

ARCHIVES OF ENVIRONMENTAL HEALTH
AMERICAN MEDICAL ASSOCIATION
535 N. DEARBORN STREET
CHICAGO, ILL. 60610

ARCHIVES INTERNATIONALES DE PHARMACODYNAMIE ET DE
THERAPIE
ALBERT BAERTSOENKAAI
GHENT, BELGIUM

ARCHIVES DES MALADIES PROFESSIONNELLES DE MEDICINE
DU TRAVAIL ET DE SECURITE SOCIALE
MASSON ET CIE
120 BLVD. SAINT-GERMAIN
75 PARIS 6, FRANCE

ARCHIVES OF OTOLARYNGOLOGY
AMERICAN MEDICAL ASSOCIATION
535 N. DEARBORN STREET
CHICAGO, ILL. 60610

ARCHIVES OF PATHOLOGY
AMERICAN MEDICAL ASSOCIATION
535 N. DEARBORN STREET
CHICAGO, ILL. 60610

ARCHIVIO DI CHIRURGIA DEL TORICA E CARDIOVASCOLARE
SANSONI EDIZIONI SCIENTIFICHE
VIALE MAZZINI 46
FLORENCE, ITALY

ARCHIVIO PER LE SCIENZE MEDICHE
EDIZIONI MINERVA MEDICA
CASELLA POSTALE 491
TORINO, ITALY

ARCHIVIO DI TISIOLOGIA E DELLE MALATTIE
DELL'APPARATO RESPIRATORIO
CLINICA TISIOLOGICA DELLA UNIVERSITA
ISTITUTO SANATORIALE
PRINCIPI DI PIEMONTE
NAPLES, ITALY

ARHIV ZA HIGIJENU RADA I TOKSIKOLOGIJU
INSTITUT ZA MEDICINSKA ISTRAZIVANJA
I MEDICINU RADA
MOSE PIJADE 158
P.O. BOX 267
ZAGREB 1, YUGOSLAVIA

ARKHIV PATOLOGII
V/O **MEZHDUNARODNAYA KNIGA**
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ARMYANSKII KHIMICHESKII ZHURNAL
V/O **MEZHDUNARODNAYA KNIGA**
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ASCATOPICS STANDARD AIR POLLUTION PROFILE
INSTITUTE FOR SCIENTIFIC INFORMATION
325 CHESTNUT STREET
PHILADELPHIA, PA., 19106

ASIAN MEDICAL JOURNAL
JAPAN MEDICAL PUBLISHERS, INC.
2-1 CHOME
NISHIKICHO, KANDA, CHIYODAKU
TOKYO, JAPAN
U.S. ADDRESS
MARUZEN COMPANY
503 FIFTH AVENUE
NEW YORK, N.Y. 10016

ASSOCIATION OF FOOD AND DRUG OFFICIALS OF THE
UNITED STATES, QUARTERLY BULLETIN
ASSOCIATION OF FOOD AND DRUG OFFICIALS
OF THE UNITED STATES
P.O. BOX 1494
TOPEKA, KAN. 66603

ATHEROSCLEROSIS
ELSEVIER PUBLISHING COMPANY
BOX 211
AMSTERDAM, NETHERLANDS

ATMOSPHERIC ENVIRONMENT
PERGAMON PRESS, INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 105[illegible]

AUFBEREITUNGS-TECHNIK (WIESBADEN)
VERLAG FUER AUFBEREITUNG SCHIRMER UND ZEH
KLEINE WILHELMSTR 5-7
WIESBADEN, GERMANY

AUSTRALASIAN ENGINEER
AUSTRALIAN INSTITUTE OF METALS
SOCIETY OF MECHANICAL ENGINEERS OF
AUSTRALASIA
116-126 CLEVELAND STREET
CHIPPENDALE, N.S.W., AUSTRALIA

AUSTRALIAN CHEMICAL PROCESSING AND ENGINEERING
LAWSON PUBLICATIONS PTY. LTD.
49 CLARENCE STREET
SYDNEY, AUSTRALIA

AUSTRALIAN JOURNAL OF CHEMISTRY
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL
RESEARCH ORGANIZATION
372 ALBERT STREET
EAST MELBOURNE
VICTORIA 3002, AUSTRALIA

AUTOMOBILE ENGINEER
ILIFFE INDUSTRIAL PUBLICATIONS LTD.
DORSET HOUSE
STAMFORD STREET
LONDON SE1, ENGLAND

AUTOMOTIVE INDUSTRIES
CHILTON COMPANY
CHESTNUT AND 56TH STREETS
PHILADELPHIA, PA. 19139

AVTOMOBIL'NAIA PROMYSHLENNOST'
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

BACTERIOLOGICAL REVIEWS
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

BANYASZATI ES KOHASZATI LAPOK
MUSZAKI KONYVKIADO VALLALAT
P.O. BOX 561
BUDAPEST 5, HUNGARY

BCURA GAZETTE
BRITISH COAL UTILISATION RESEARCH
ASSOCIATION INFORMATION SERVICE
RANDALLS ROAD
SURREY, ENGLAND

BEITRAEGE ZUR SILIKOSE-FORSCHUNG, SONDERBAND
HAUPTVERWALTUNG DER
BERGBAU-BERUFSGENOSSENSCHAFT
HUNSCHEIDTSTR 18,
463 BOCHUM, GERMANY

BENDIX TECHNICAL JOURNAL
BENDIX CORPORATION
DETROIT, MICHIGAN

BERGBAUTECHNIK
VEB DEUTSCHER VERLAG FUR
GRUNDSTOFFINDUSTRIE
KARL-HEINE-STR. 27
7031 LEIPZIG, E. GERMANY

BERICHTE DER BUNSENGESELLSCHAFT FUER PHYSIKALISCHE
CHEMIE
VERLAG CHEMIE GMBH
6940 WEINHEIM
BERGSTR., W. GERMANY

BIOCHEMICAL JOURNAL
CHEMICAL SOCIETY
BURLINGTON HOUSE, PICADILLY
LONDON W.1, ENGLAND

BIOCHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET N.W.
WASHINGTON, D.C. 20036

BIOCHIMICA ET BIOPHYSICA ACTA
ELSEVIER PUBLISHING COMPANY
SPUISTRAAT 110-112
AMSTERDAM C, NETHERLANDS

BIOLOGIA (BRATISLAVA)
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

BIOLOGICHESKII ZHURNAL ARMENII
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

BIOLOGISCHES ZENTRALBLATT
VED GEORG THIEME
HAINSTRASSE 17-19
701 LEIPZIG, E. GERMANY

BIOMEDICAL SCIENCES INSTRUMENTATION
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

BIOPHYSICS (ENGLISH TRANSLATION OF BIOFIZIKA)
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

BIOSCIENCE
AMERICAN INSTITUTE OF BIOLOGICAL
SCIENCES
3900 WISCONSIN AVENUE, N.W.
WASHINGTON, D.C. 20016

BITUMEN TEERE ASPHALTE PECHE
STRASSENBAUVERLAG, CHEMIE UND TECHNIK
VERLAGSGESELLSCHAFT MBH
POSTFACH 1508
HEIDELBERG, GERMANY

BIULETYN WARZYWNICZY
PANSTWOWE WYDAWNICTWO ROLNICZE I LESNE
WARSAW, POLAND

BLAST FURNACE AND STEEL PLANT
STEEL PUBLICATIONS, INC.
624 GRANT BUILDING
PITTSBURGH, PA. 15230

BLOOD
HENRY M. STRATTON
381 PARK AVENUE, S.
NEW YORK, N.Y. 10016

BOLETIN DE LA OFICINA SANITARIA PANAMERICANA
PAN AMERICAN SANITARY BUREAU
525 23RD STREET, N.W.
WASHINGTON, D.C. 20037

BOSHOKU GIJUTSU (CORROSION ENGINEERING)
NIPPON GAKUJUTSU SHINKOKAI FUSHOKU
BOSHI DAI 97 IINKAI
1,1-CHOME, KANDA-HITOTSUBASHI
CHIYODA-KU, TOKYO, JAPAN

BOSTON COLLEGE INDUSTRIAL AND COMMERCIAL LAW REVIEW
BOSTON LAW SCHOOL
BRIGHTON, MASS. 02135

BOTANICAL GAZETTE
UNIVERSITY OF CHICAGO PRESS
5750 ELLIS AVENUE
CHICAGO, ILL. 60637

BOUNDARY LAYER METEOROLOGY
D. REIDEL PUBLISHING CO.
419-421 SINGEL, BOX 17
DORDRECHT, NETHERLANDS

BRATISLAVSKE LEKARSKE LISTY
SLOVAK ACADEMY OF SCIENCE
KLEMENSOVA 27
BRATISLAVA, CZECHOSLOVAKIA

BRENNSTOFF - WAERME - KRAFT
VDI-VERLAG GMBH.
POSTFACH 1139
4 DUESSELDORF, GERMANY

BRITISH CHEMICAL ENGINEERING
HEYWOOD-TEMPLE INDUSTRIAL PUBLICATIONS LTD.
33-39 BOWLING GREEN LANE
LONDON E.C.1, ENGLAND

BRITISH CLAYWORKER
BRITISH CLAYWORKER
46 CHANCERY LANE
LONDON, ENGLAND

BRITISH COAL UTILISATION RESEARCH ASSOCIATION MONTHLY BULLETIN
BRITISH COAL UTILISATION RESEARCH
ASSOCIATION INFORMATION SERVICE
RANDALLS ROAD
SURREY, ENGLAND

BRITISH CORROSION JOURNAL
BRITISH JOINT CORROSION GROUP
14 BELGRAVE SQUARE
LONDON, ENGLAND

BRITISH JOURNAL OF ANAESTHESIA
JOHN SHERRATT AND SON LTD.
PARK ROAD
ALTRINCHAM, ENGLAND

BRITISH JOURNAL OF CANCER
H.K. LEWIS AND COMPANY, LTD.
136 GOWER STREET
LONDON W.C.1, ENGLAND

BRITISH JOURNAL OF CLINICAL PRACTICE
HARVEY AND BLYTHE LTD.
LLOYDS BANK CHAMBERS
216 CHURCH ROAD
HOVE, SUSSEX, ENGLAND

BRITISH JOURNAL OF DISEASES OF THE CHEST
BAILLIERE, TINDALL AND CASSELL LTD.
8 HENRIETTA STREET
LONDON W.C.2, ENGLAND

BRITISH JOURNAL OF EXPERIMENTAL PATHOLOGY
H.K. LEWIS AND COMPANY, LTD.
136 GOWER STREET
LONDON W.C.1, ENGLAND

BRITISH JOURNAL OF INDUSTRIAL MEDICINE
BRITISH MEDICAL ASSOCIATION HOUSE
TAVISTOCK SQUARE
LONDON, ENGLAND
U.S. ADDRESS
BRITISH MEDICAL ASSOCIATION
80 BRIGHTON AVENUE
BOSTON, MASS. 02134

BRITISH JOURNAL OF PREVENTIVE AND SOCIAL MEDICINE
BRITISH MEDICAL ASSOCIATION
80 BRIGHTON AVENUE
BOSTON, MASS. 02134

BRITISH MEDICAL BULLETIN
BRITISH COUNCIL, MEDICAL DEPARTMENT
65 DAVIES STREET
LONDON W.C.1, ENGLAND

BRITISH MEDICAL JOURNAL
BRITISH MEDICAL ASSOCIATION HOUSE
TAVISTOCK SQUARE
LONDON, ENGLAND
U.S. ADDRESS
BRITISH MEDICAL ASSOCIATION
90 BRIGHTON AVENUE
BOSTON, MASS. 02134

LES BRONCHES
DOIN ET CIE
8, PL DE L'ODEON
PARIS, FRANCE

BRUXELLES - MEDICAL
BRUXELLES-MEDICAL
87 RUE BELLIARD
BRUSSELS 4, BELGIUM

BUDAPESTI-KOZEGESZSEGUGY
BUDAPEST FOVAROSI KOZEGESZSEGUGYI-
JARVANYUGYI ALLOMAS
VACI UT 174
BUDAPEST 8, HUNGARY

BUILDING SYSTEMS DESIGN
INDUSTRIAL PRESS INC.
200 MADISON AVENUE
NEW YORK, N.Y. 10016

BULLETIN DE L'ACADEMIE NATIONALE DE MEDECINE
MASSON ET CIE
120, BLVD. SAINT-GERMAIN, 75
PARIS 6, FRANCE

BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY
AMERICAN METEOROLOGICAL SOCIETY
45 BEACON STREET
BOSTON, MASS. 02108

BULLETIN OF THE ATOMIC SCIENTISTS
EDUCATIONAL FOUNDATION FOR NUCLEAR SCIENCE
935 E. 60TH STREET
CHICAGO, ILL. 60637

BULLETIN OF THE CHEMICAL SOCIETY OF JAPAN
NIPPON KAGAKUKAI
5, 1-CHOME, KANDA-SURUGADAI
CHIYSDA-KU, TOKYO, JAPAN

BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY
SPRINGER-VERLAG
HEIDELBERGER PL 3
1 BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

BULLETIN OF EXPERIMENTAL BIOLOGY AND MEDICINE (U.S.S.R.)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

BULLETIN OF THE INSTITUTE OF MARINE MEDICINE IN GDANSK
INSTYTUT MEDYCYNY MORSKIEJ
UL HIBNERA 1-C
GDANSK, POLAND

BULLETIN OF J.S.M.E. (JAPAN SOCIETY OF MECHANICAL ENGINEERS)
MARUZEN COMPANY, LTD.
EXPORT DEPARTMENT
CENTRAL P.O. BOX 605
TOKYO 100-91, JAPAN

BULLETIN OF THE JAPAN PETROLEUM INSTITUTE
MARUZEN COMPANY, LTD.
EXPORT DEPARTMENT
CENTRAL P.O. BOX 605
TOKYO 100-91, JAPAN

BULLETIN OF THE NEW YORK ACADEMY OF MEDICINE
STECHERT-HAFNER SERVICE AGENCY INC.
31 E. 10TH STREET
NEW YORK, N.Y. 10003

BULLETIN OF THE POSTGRADUATE COMMITTEE IN MEDICINE, UNIVERSITY OF SYDNEY
UNIVERSITY OF SYDNEY
SYDNEY, NEW SOUTH WALES, AUSTRALIA

BULLETIN DE LA SOCIETE DE CHIMIE BIOLOGIQUE
MASSON ET CIE
120, BLVD. SAINT-GERMAIN
75 PARIS 6, FRANCE

Reproduced from
best available copy.

BULLETIN DE LA SOCIETE CHIMIQUE DE FRANCE
MASSON ET CIE
120, BLVD. SAINT-GERMAIN
75 PARIS 6, FRANCE

BULLETIN DE LA SOCIETE DES SCIENCES MEDICALES DU GRAND-DUCHE DE LUXEMBOURG
SOCIETE DES SCIENCES MEDICALES DU
GRAND-DUCHE DE LUXEMBOURG
30 BD. D'AVRANCHES
LUXEMBOURG, LUXEMBOURG

BULLETIN OF THE WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTE
SERVICE DE DISTRIBUTION ET DE VENTE
GENEVA, SWITZERLAND

BULLETIN OF THE YAMAGUCHI MEDICAL SCHOOL
YAMAGUCHI KENRITSU IKA DAIGAKU
MEDICAL LIBRARY
OGUSHI, UBE, JAPAN

BUMAZHNAIA PROMYSHLENNOST'
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

BUNSEKI KAGAKU (JAPAN ANALYST)
NIPPON BUNSEKI KAGAKKAI
C/O TOKYO KOGYO SHIKENSHO
1-1, HON-MACHI SHIBUYA-KU
TOKYO, JAPAN

BUNSEKI KIKI (ANALYTICAL INSTRUMENTS)
1-11-10, KANDA
CHIYODA-KU, TOKYO, JAPAN

C.A. - A CANCER JOURNAL FOR CLINICIANS
AMERICAN CANCER SOCIETY, INC.
CIRCULATION MANAGER
219 E. 42ND STREET
NEW YORK, N.Y. 10017

C.E.E.R. - CHEM ECONOMY, AND ENGINEERING REVIEW
CHEMICAL ECONOMY RESEARCH INSTITUTE
SHIKOKU BANK BUILDING
13-7, 1-CHOME UCHI-KANDA CHIYODA-KU
TOKYO 101, JAPAN

C.I.M. BULLETIN
CANADIAN INSTITUTE OF MINING AND
METALLURGY
903-1117 ST. CATHERINE STREET, W.
MONTREAL 2, CANADA

C.S.I.R. RESEARCH REVIEW (COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH)
DISTRIBUTOR OF PUBLICATIONS
C.S.I.R.
P.O. BOX 395
PRETORIA, SOUTH AFRICA

CALIFORNIA AGRICULTURE
AGRICULTURAL PUBLICATIONS
207 UNIVERSITY HALL
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIF. 94720

CALIFORNIA MEDICINE
CALIFORNIA MEDICAL ASSOCIATION
693 SUTTER STREET
SAN FRANCISCO, CALIF. 94102

CANADIAN CHEMICAL PROCESSING
SOUTHAM BUSINESS PUBLICATIONS LTD.
1450 DON MILLS ROAD
DON MILLS, ONTARIO, CANADA

CANADIAN JOURNAL OF BOTANY
NATIONAL RESEARCH COUNCIL OF CANADA
ADMINISTRATION
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF CHEMICAL ENGINEERING
CHEMICAL INSTITUTE OF CANADA
151 SLATER STREET
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF CHEMISTRY
NATIONAL RESEARCH COUNCIL OF CANADA
ADMINISTRATION
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF GENETICS AND CYTOLOGY
DR. A.S. JOHNSON, TREASURER
CENTRAL EXPERIMENTAL FARM
P.O. BOX 65
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF MICROBIOLOGY
NATIONAL RESEARCH COUNCIL OF CANADA
ADMINISTRATION
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF PHYSICS
NATIONAL RESEARCH COUNCIL OF CANADA
ADMINISTRATION
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF PHYSIOLOGY AND PHARMACOLOGY
NATIONAL RESEARCH COUNCIL OF CANADA
ADMINISTRATION
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF PLANT SCIENCE
AGRICULTURAL INSTITUTE OF CANADA
151 SLATER STREET
OTTAWA, ONTARIO, CANADA

CANADIAN JOURNAL OF PUBLIC HEALTH
CANADIAN PUBLIC HEALTH ASSOCIATION
1255 YONGE STREET
TORONTO, ONTARIO, CANADA

CANADIAN JOURNAL OF SOIL SCIENCE
AGRICULTURAL INSTITUTE OF CANADA
151 SLATER STREET
OTTAWA, ONTARIO, CANADA

CANADIAN MEDICAL ASSOCIATION JOURNAL
CANADIAN MEDICAL ASSOCIATION
150 ST. GEORGE STREET
TORONTO, ONTARIO, CANADA

CANADIAN MINING JOURNAL
NATIONAL BUSINESS PUBLICATIONS LTD.
GARDENVALE, QUEBEC, CANADA

CANCER (PHILADELPHIA)
J.B. LIPPINCOTT COMPANY
227 S. 6 TH STREET
PHILADELPHIA, PA. 19105

CANCER BULLETIN
ANDERSON HOSPITAL AND TUMOR INSTITUTE
6723 BERTNER DRIVE
HOUSTON, TEXAS 77025

CANCER RESEARCH
WILLIAMS AND WILKINS COMPANY
42[illegible] PRESTON STREET
BALTIMORE, [illegible] 212[illegible]2

CELULOZA SI HIRTIE (BUCHAREST)
CARTIMEX
CASUTA POSTALA 134-135
BUCHAREST, ROMANIA

CENTRAL AFRICAN JOURNAL OF MEDICINE
CENTRAL AFRICAN JOURNAL OF MEDICINE
ASSISTANT EDITOR
P.O. BOX [illegible]73
SALISBURY, RHODESIA

CENTRAL ELECTRICITY GENERATING BOARD DIGEST
SUDBURY HOUSE
15 NEWGATE STREET
LONDON EC1, ENGLAND

CERAMIC AGE
BUSINESS COMMUNICATIONS, INC.
SUITE 207
2800 EUCLID AVENUE
CLEVELAND, OHIO 44115

CESKOSLOVENSKA GASTROENTEROLOGIE A VYZIVA
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

CESKOSLOVENSKA HYGIENA
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

CESKOSLOVENSKA OTOLARYNGOLOGIE
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

CESKOSLOVENSKA PEDIATRIE
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

CHEM 26 PAPER PROCESSING
A. STEWART HALE
1521 SUMMER STREET
STANFORD, CONN. 06905

CHEMIA ANALITYCZNA (WARSAW)
RUCH
UL WRONIA 23
WARSAW 1, POLAND

CHEMICAL ABSTRACTS
CHEMICAL ABSTRACT SERVICE
OHIO STATE UNIVERSITY
COLUMBUS, OHIO 43210

CHEMICAL AGE (LONDON)
BENN BROTHERS LTD.
BOUVERIE HOUSE
154 FLEET STREET
LONDON EC4, ENGLAND

CHEMICAL COMMUNICATIONS
CHEMICAL SOCIETY
BURLINGTON HOUSE
LONDON W1V 0BN, ENGLAND

CHEMICAL ENGINEERING
MCGRAW-HILL INC.
330 W. 42ND STREET
NEW YORK, N.Y. 10036

CHEMICAL AND ENGINEERING NEWS
AMERICAN CHEMICAL SOCIETY
1155 SIXTEENTH STREET, N.W.
WASHINGTON, D.C. 20036

CHEMICAL ENGINEERING PROGRESS
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

CHEMICAL ENGINEERING SCIENCE
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

CHEMICAL PHYSICS LETTERS (AMSTERDAM)
NORTH-HOLLAND PUBLISHING COMPANY
P.O. BOX 103
AMSTERDAM C, NETHERLANDS

CHEMICAL AND PROCESS ENGINEERING
MORGAN-GRAMPIAN (PUBLISHERS) LTD.
28 ESSEX STREET
LONDON WC2, ENGLAND

CHEMICAL PROCESSING
PUTMAN PUBLISHING COMPANY
111 E. DELAWARE PLACE
CHICAGO, ILL. 60611

CHEMICAL REVIEWS
AMERICAN CHEMICAL SOCIETY
1155 SIXTEENTH STREET, N.W.
WASHINGTON, D.C. 20036

CHEMICAL WEEK
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 10036

CHEMICKE LISTY
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

CHEMICKY PRUMYSL
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

CHEMICO-BIOLOGICAL INTERACTIONS
ELSEVIER PUBLISHING CO.
P.O. BOX 211
AMSTERDAM, NETHERLANDS

CHEMIE - INGENIEUR - TECHNIK
VERLAG CHEMIE GMBH
PAPPELALLE 3
6940 WEINHEIM/BERGSTR.
GERMANY

CHEMIE EN TECHNICK
VERENIGING VAN HOGER CHEMISCH PERSONEEL
POSTBUS 30
ZOETERMEER, NETHERLANDS

CHEMIKER-ZEITUNG
DR. ALFRED HUETHIG VERLAG GMBH
WILCKENSSTR 3/5
6900 HEIDELBERG, GERMANY

CHEMISCH WEEKBLAD
KONINKLIJKE NEDERLANDSE CHEMISCHE
VERENIGING, AFDELING TIJDSCHRIFTEN
BURNIERSTRAAT 1
THE HAGUE, NETHERLANDS

CHEMISCHE INDUSTRIE (DUESSELDORF)
VERLAG HANDELSBLATT GMBH
POSTFACH 1102
4000 DUESSELDORF, GERMANY

CHEMISCHE TECHNIK (BERLIN)
VEB DEUTSCHER VERLAG FUR
GRUNDSTOFFINDUSTRIE
LEIPZIG, GERMANY

CHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 SIXTEENTH STREET, N.W.
WASHINGTON, D.C. 20036

CHEMISTRY IN CANADA
CHEMICAL INSTITUTE OF CANADA
151 SLATER STREET
OTTAWA, ONTARIO, CANADA

CHEMISTRY AND INDUSTRY (LONDON)
SOCIETY OF CHEMICAL INDUSTRY
14 BELGRAVE SQUARE
LONDON SW1, ENGLAND

CHEMOSPHERE
PERGAMON PRESS INC.
MAXWELL HOUSE
FAIRVIEW PARK
ELMSFORD, N.Y. 10523

CHEST
AMERICAN COLLEGE OF CHEST PHYSICIANS
112 E. CHESTNUT STREET
CHICAGO, ILL. 60611

CHIMICA E L'INDUSTRIA (MILAN)
EDITRICE DI CHIMICA S PA
PIAZZALE R. MORANDI, 2
20121 MILAN, ITALY

CHIMIE ANALYTIQUE (PARIS)
SOCIETE DE PRODUCTIONS DOCUMENTAIRES
SERVICE ABONNEMENTS
80, ROUTE DE SAINT-CLOUD
RUEIL-MALMAISON, FRANCE

CHIMIE ET INDUSTRIE, GENIE CHIMIQUE
SOCIETE DE PRODUCTIONS DOCUMENTAIRES
SERVICE ABONNEMENTS
80, ROUTE DE SAINT-CLOUD
RUEIL-MALMAISON, FRANCE

CHINESE MEDICAL JOURNAL
CHINESE MEDICAL ASSOCIATION BUILDING
P.O. BOX 399
PEKING, CHINA

CINCINNATI JOURNAL OF MEDICINE
ACADEMY OF MEDICINE OF CINCINNATI
CINCINNATI, OHIO 45201

CIRCULATION
AMERICAN HEART ASSOCIATION
44 E. 23RD STREET
NEW YORK, N.Y. 10010

CITRUS INDUSTRY
CITRUS INDUSTRY
P.O. BOX 89
BARTOW, FLORIDA 33830

CIVIL ENGINEERING (NEW YORK)
CIVIL ENGINEERING
345 E. 47TH STREET
NEW YORK, N.Y. 10017

CLAYCRAFT AND STRUCTURAL CERAMICS
LONDON AND SHEFFIELD PUBLISHING COMPANY LTD.
7 CHESTERFIELD GARDENS
CURZON STREET
LONDON, ENGLAND

CLEAN AIR
CIRCULATION MANAGER
151 NORTHERN ROAD
HEIDELBERG, VICTORIA
AUSTRALIA 3081

CLEVELAND PHYSICIAN
CLEVELAND CLINIC FOUNDATION
2020 E. 93RD STREET
CLEVELAND, OHIO 44106

CLINICAL PEDIATRICS (PHILADELPHIA)
J.B. LIPPINCOTT COMPANY
227 S. 6TH STREET
PHILADELPHIA, PA. 19106

CLINICAL SCIENCE
BLACKWELL SCIENTIFIC PUBLICATIONS LTD.
5 ALFRED STREET
OXFORD, ENGLAND

CLINICAL TOXICOLOGY
MARCEL DEKKER
95 MADISON AVENUE
NEW YORK, N.Y.

COAL, GOLD, AND BASE MINERALS OF SOUTHERN AFRICA
PITHEAD PRESS (PTY) LTD.
P.O. BOX 9002
JOHANNESBURG, S. AFRICA

COAL AGE
COAL AGE
P.O. BOX 430
HIGHTSTOWN, N.J. 08520

COAL RESEARCH IN C.S.I.R.O.
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL
RESEARCH ORGANIZATION
372 ALBERT STREET
EAST MELBOURNE, VICTORIA 3002
AUSTRALIA

COBALT
CENTRE D'INFORMATION DU COBALT
35 RUE DES COLONIES
BRUSSELS, BELGIUM
U.S. ADDRESS
COBALT INFORMATION CENTER
C/O BATTELLE MEMORIAL INSTITUTE
505 KING AVENUE
COLUMBUS, OHIO 432 1

COKE AND CHEMISTRY (U.S.S.R.) (ENGLISH TRANSLATION
OF KOKS I KHIMIYA)
COAL TAR RESEARCH ASSOCIATION
OXFORD ROAD, GOMERSAL
CLECKHEATON, YORKSHIRE, ENGLAND

COLLECTION OF CZECHOSLOVAK CHEMICAL
COMMUNICATIONS
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

COLLIERY GUARDIAN
FUEL AND METALLURGICAL JOURNALS LTD.
JOHN ADAM HOUSE
17-19, JOHN ADAM STREET
LONDON, ENGLAND

COLLOID JOURNAL OF THE U.S.S.R. (ENGLISH REANSLATIO
KOLLOID ZHURNAL)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

COMBUSTION
COMBUSTION PUBLISHING COMPANY INC.
277 PARK AVENUE
NEW YORK, N.Y. 10017

COMBUSTION AND FLAME
BUTTERWORTH AND COMPANY (PUBLISHERS) LTD.
88 KINGSWAY
LONDON WC2, ENGLAND

COMBUSTION SCIENCE AND TECHNOLOGY
GORDON AND BREACH SCIENCE
PUBLISHERS INC.
150 FIFTH AVENUE
NEW YORK, N.Y. 10011

COMMUNITY HEALTH
ROYAL INSTITUTE OF PUBLIC HEALTH
AND HYGIENE
26 PORTLAND PLACE
LONDON, ENGLAND

COMPOST SCIENCE
RODALE PRESS, INC.
33 E. MINOR STREET
EMMAUS, PA. 18049

COMPTES RENDUS HEBDOMADAIRES DES SEANCES DE
L'ACADEMIE DES SCIENCES
GAUTHIER-VILLARS
55, QUAI DES GRANDS-AUGUSTINS
PARIS 6, FRANCE

COMPTES RENDUS DES SEANCES DE LA SOCIETE DE
BIOLOGIE ET DE SES FILIALES
MASSON ET CIE
120, BLVD. SAINT-GERMAIN
75 PARIS 6, FRANCE

COMPUTERS AND BIOMEDICAL RESEARCH
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

CONCOURS MEDICAL
CONCOURS MEDICAL
37 RUE DE BELLEFOND
PARIS, FRANCE

CONDIZIONAMENTO DELL'ARIA
CONDIZIONAMENTO DELL'ARIA
VIA DISCIPLINI 7
20123 MILAN, ITALY

CONNECTICUT HEALTH BULLETIN
CONNECTICUT STATE DEPARTMENT OF HEALTH
79 ELM STREET
HARTFORD, CONN. 06115

CONNECTICUT MEDICINE
CONNECTICUT MEDICINE
160 ST. RONAN STREET
NEW HAVEN, CONN. 06511

CONSULTING ENGINEER (MICHIGAN)
CONSULTING ENGINEER
217 WAYNE STREET
ST. JOSEPH, MICH. 49085

CONTAMINATION CONTROL
BLACKMENT PUBLISHING COMPANY INC.
1605 CAHUENGA BOULEVARD
LOS ANGELES, CALIF. 90028

CONTRIBUTIONS TO ATMOSPHERIC PHYSICS
AKADEMISCHE VERLAGSGESELLSCHAFT GMBH.
CRONSTETTENSTR. 6A
FRANKFURT AM MAIN, GERMANY

CORROSION
NATIONAL ASSOCIATION OF CORROSION
ENGINEERS
2400 W. LOOP
HOUSTON, TEXAS 77027

CORROSION SCIENCE
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

CRITICAL REVIEWS IN ENVIRONMENTAL CONTROL
CHEMICAL RUBBER COMPANY
18901 CRANWOOD PARKWAY
CLEVELAND, OHIO 44129

CZECHOSLOVAK HEAVY INDUSTRY
RAPID
UL. 28 RIJNA 13
PRAGUE 1, CZECHOSLOVAKIA

CZECHOSLOVAK MOTOR REVIEW
RAPID
UL. 28 RIJNA 13
PRAGUE 1, CZECHOSLOVAKIA

DANISH MEDICAL BULLETIN
UGESKRIFT FOR LAEGER
DOMUS MEDICA, 2100
COPENHAGEN, DENMARK

DELAWARE VALLEY INDUSTRY
PERCY PUBLICATIONS
1[illegible] SUMMER STREET
PHILADELPHIA, PA. 19103

DEUTSCHE GESUNDHEITSWESEN
VEB VERLAG VOLK UND GESUNDHEIT
NEUE GRUENSTR 18
102 BERLIN, E. GERMANY

DEUTSCHE LEBENSMITTEL-RUNDSCHAU
WISSENSCHAFTLICHE VERLAGSGESELLSCHAFT MBH
POSTFACH 40
7 STUTTGART, GERMANY

DEUTSCHE MEDIZINISCHE WOCHENSCHRIFT
GEORG THIEME VERLAG
HERDWEG 63
7000 STUTTGART 1, GERMANY

DIESEL AND GAS TURBINE PROGRESS
BRUCE W. WADMAN
11225 W. BLUEMOUND ROAD
P.O. BOX 7406
MILWAUKEE, WIS. 53213

DOBOKU GAKKAI RONBUNSHU (TRANSACTIONS OF THE
JAPAN SOCIETY OF CIVIL ENGINEERS)
JAPAN SOCIETY OF CIVIL ENGINEERS
1, YOTSUYA, SHINJUKU-KU
TOKYO, JAPAN

DOBOKU GAKKAISHI (JOURNAL OF THE JAPAN SOCIETY
OF CIVIL ENGINEERS)
JAPAN SOCIETY OF CIVIL ENGINEERS
1, YOTSUYA, SHINJUKU-KU
TOKYO, JAPAN

DOKLADY AKADEMII NAUK S.S.S.R. (ENGLISH TITLES)
V/O MEZHDUNARODNAYA KNIGA
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

DOKLADY AKADEMII NAUK S.S.S.R., SERIIA BIOLOGIIA
(SEE DOKLADY, BIOLOGICAL SCIENCES,
ENGLISH TRANSLATION)

DOKLADY AKADEMII NAUK S.S.S.R., SERIIA KHIMIIA
(SEE DOKLADY CHEMISTRY)

DOKLADY CHEMICAL TECHNOLOGY
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

DRAEGER REVIEW (ENGLISH TRANSLATION OF DRAEGER
HEFTE)
DRAEGERWERK
LITERARY DEP
LUEBECK, GERMANY

E.E.I. BULLETIN
EDISON ELECTRIC INSTITUTE
750 THIRD AVENUE
NEW YORK, N.Y. 10017

E/MJ (ENGINEERING AND MINING JOURNAL)
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 10036

EARTH AND PLANETARY SCIENCE LETTERS
NORTH-HOLLAND PUBLISHING COMPANY
P.O. BOX 103
AMSTERDAM C, NETHERLANDS

ECOLOGY
DUKE UNIVERSITY PRESS
CIRCULATION OFFICE
P.O. BOX 6697
COLLEGE STATION
DURHAM, N.C. 27708

EFFLUENT AND WATER TREATMENT JOURNAL
THUNDERBIRD ENTERPRISES LTD.
3 CLEMENT'S INN
LONDON, ENGLAND

EGESZSEGTUDOMANY
KULTURA
P.O. BOX 149
BUDAPEST 62, HUNGARY

EISEI KAGAKU (JOURNAL OF HYGIENIC CHEMISTRY)
NIPPON YAKUGAKKAI
TOKYO DAIGAKU YAKUGAKU-BU
7-3-1, HONGO, BUNKYO-KU
TOKYO, JAPAN

EISEI KOGAKU (JOURNAL OF THE DEPARTMENT OF
SANITARY ENGINEERING, HOKKAIDO UNIVERSITY)
HOKKAIDO UNIVERSITY
DEPARTMENT OF SANITARY ENGINEERING
HOKKAIDO, JAPAN

EISEI SHIKENSHO HOKOKU (BULLETIN OF NATIONAL
INSTITUTE OF HYGIENIC SCIENCES)
KOSEI-SHO KOKURITSU EISEI SHIKENJO
2-2[illegible] 3, TAMAGAWA YOGA-MACHI
SETAGAYA-KU, TOKYO, JAPAN

EKISTICS
ATHENS CENTER OF EKISTICS
ATHENS, GREECE

ELECTRIC LIGHT AND POWER
CAHNERS PUBLISHING COMPANY
221 COLUMBUS AVENUE
BOSTON, MASS. 0211[illegible]

ELECTRICAL REVIEW
ILIFFE INDUSTRIAL PUBLICATIONS LTD.
DORSET HOUSE, STAMFORD STREET
LONDON SE1, ENGLAND

ELECTRICAL WORLD
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 100[illegible]

ELECTRO-TECHNOLOGY NEWSLETTER
CONOVER-MAST PUBLICATIONS, INC.
205 E. 42ND STREET
NEW YORK, N.Y. 10017

ELECTROCHIMICA ACTA
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

ELECTRONIC DESIGN
HAYDEN PUBLISHING COMPANY INC.
850 THIRD AVENUE
NEW YORK, N.Y. 10022

ELECTRONICS AND POWER
INSTITUTION OF ELECTRICAL ENGINEERS
SAVOY PLACE
LONDON WC2, ENGLAND

ELEKTRICHESKIE STANTSII
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ELEKTROTECHNISCHE ZEITSCHRIFT AUSG. A
VDE-VERLAG GMBH
BISMARCKSTR 33
1 BERLIN, GERMANY

ELEKTROTECHNISCHE ZEITSCHRIFT AUSG. B
VDE-VERLAG GMBH
BISMARCKSTR 33
1 BERLIN, GERMANY
ENERGETIK
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ENERGIA ES ATOMTECHNIKA
KULTURA
P.O. BOX 149
BUDAPEST 62, HUNGARY

ENERGIE (MUNICH)
TECHNISCHER VERLAG RESCH KG
8032 GRAEFELFING
MUNICH, GERMANY

ENERGIE U TECHNIK
POSTFACH 112
4 DUESSELDORF
WEST GERMANY

ENERGIETECHNIK
VEB DEUTSCHER VERLAG FUER
GRUNDSTOFFINDUSTRIE
KARL-HEINE-STR. 27
7031 LEIPZIG, E. GERMANY

ENGEI GAKKAI ZASSHI (JOURNAL OF THE JAPANESE SOCIET
FOR HORTICULTURAL SCIENCE)
TOKYO DAIGAKU NOGAKUBU
ENGEIGAKU KYOSHITSU
1-1-1, YAYOI-CHO, BUNKYO-KU
TOKYO, JAPAN

ENGELHARD INDUSTRIES TECHNICAL BULLETIN
ENGELHARD INDUSTRIES
RESEARCH AND DEVELOPMENT
497 DELANCY STREET
NEWARK, N.J. 07105

ENGINEER (NEW YORK)
ENGINEERS JOINT COUNCIL
345 E. 47TH STREET
NEW YORK, N.Y. 10017

ENGINEERING
ENGINEERING LTD.
36 BEDFORD STREET
LONDON, ENGLAND
U.S. ADDRESS
STECHERT-HAFNER SERVICE AGENCY INC.
31 E. 10TH STREET
NEW YORK, N.Y. 10003

ENGINEERING INDEX CARD-A LERT
ENGINEERING INDEX, INC.
345 E. 47TH STREET
NEW YORK, N.Y. 10017

ENGINEERING JOURNAL (MONTREAL)
ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET
MONTREAL, QUEBEC, CANADA

ENGINEER'S DIGEST
U.S. COAST GUARD
1300 E STREET, N.W.
WASHINGTON, D.C. 20226

ENVIRONMENT
COMMITTEE FOR ENVIRONMENTAL
INFORMATION
438 N. SKINKER BOULEVARD
ST. LOUIS, MO. 63130

ENVIRONMENT THIS MONTH
ITP ENVIRONMENT LTD.
P.O. BOX 55
ST. LEONARD'S HOUSE
LANCASTER, ENGLAND

ENVIRONMENTAL AFFAIRS
ENVIRONMENTAL LAW CENTER
BOSTON LAW SCHOOL
BRIGHTON, MASS. 02135

ENVIRONMENTAL HEALTH (INDIA)
CENTRAL PUBLIC HEALTH ENGINEERING
RESEARCH INSTITUTE
DIRECTOR
NAGPUR, INDIA

ENVIRONMENTAL HEALTH (LONDON)
ASSOCIATION OF PUBLIC HEALTH INSPECTORS
19 GROSVENOR PLACE
LONDON SW1, ENGLAND
ENVIRONMENTAL LETTERS
MARCEL DEKKER, INC.
95 MADISON AVENUE
NEW YORK, N.Y. 10016

ENVIRONMENTAL POLLUTION
ELSEVIER PUBLISHING COMPANY LTD.
BARKING, ESSEX, ENGLAND

ENVIRONMENTAL RESEARCH (NEW YORK/LONDON)
ACADEMIC PRESS INC., LTD.
BERKELEY SQUARE HOUSE
BERKELEY SQUARE
LONDON W1, ENGLAND
U.S. ADDRESS
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

ENVIRONMENTAL SCIENCE AND TECHNOLOGY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

ENZYMOLOGIA
DR. W. JUNK, NAAMLOZE VENNOOTSCHAP
THE HAGUE, NETHERLANDS

ERDOEL UND KOHLE, ERDGAS, PETROCHEMIE
INDUSTRIEVERLAG VON HERNHAUSSEN KG
[illegible]GSMARKT 24
HAMBURG, GERMANY

ETHYL MAGAZINE
ETHYL CORPORATION
CORPORATE PUBLIC RELATIONS DEPARTMENT
100 PARK AVENUE
NEW YORK, N.Y. 10017

EXPERIMENTAL AND MOLECULAR PATHOLOGY
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

EXPERIMENTAL NEUROLOGY
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003
EYE, EAR, NOSE AND THROAT MONTHLY
PROFESSIONAL PRESS, INC., PUBLISHERS
ROOM 1410
5 N. WABASH AVENUE
CHICAGO, ILL. 60602

Reproduced from
best available copy.

FARMAKOLOGIYA I TOKSIKOLOGIYA (PHARMACOLOGY AND
TOXICOLOGY)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

FEDERAL REGISTER
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

FEDERATION PROCEEDINGS
FEDERATION OF AMERICAN SOCIETIES FOR
EXPERIMENTAL BIOLOGY
9650 ROCKVILLE PIKE
BETHESDA, MD. 20014

FILTRATION AND SEPARATION
UPLANDS PRESS LTD.
1 KATHERINE STREET
CROYDON, ENGLAND

FIRE COMMAND
NATIONAL FIRE PROTECTION ASSOCIATION
60 BATTERYMARCH STREET
BOSTON, MASS. 02110

FIRE ENGINEERING
FIRE ENGINEERING
466 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

FIRE TECHNOLOGY
SOCIETY OF FIRE PROTECTION ENGINEERS
60 BATTERYMARCH STREET
BOSTON, MASS. 02110

FIZIKA ATMOSFERI I OKEANA (ENGLISH TITLES)
ATMOSPHERIC AND OCEANIC PHYSICS-ENG.
V/O MEZHDUNARODNAYA KNIGA
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

FIZIKA GORENIIA I VZRYVA
FIZIKA GORENIIA I VZRYVA
NOVOSIBIRSK 90, U.S.S.R.

FIZIOLOHICHNYI ZHURNAL, AKADEMIIA NAUK UKRAINSKOI
R.S.R.
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

FLOW LINE
ROCKWELL MANUFACTURING COMPANY
400 N. LEXINGTON AVENUE
PITTSBURGH, PA. 15208

FLUORIDE ABSTRACTS
KETTERING LABORATORY
DEPARTMENT OF ENVIRONMENTAL HEALTH
COLLEGE OF MEDICINE
UNIVERSITY OF CINCINNATI
CINCINNATI, OHIO

FLUORIDE QUARTERLY REPORTS (JOURNAL OF THE
INTERNATIONAL SOCIETY FOR FLUORIDE RESEARCH)
INTERNATIONAL SOCIETY FOR FLUORIDE,
RESEARCH, INC.
2930 W. GRAND BOULEVARD
DETROIT, MICH. 48202

FOLIA MEDICA (NAPLES)
FOLIA MEDICA
VIA RAFFAELE DE CESARE, 31
NAPLES, ITALY

FOLIA MEDICA (PLOVDIV)
INSTITUT DE HAUTES ETUDES MEDICALE
I.P. PAVLOV, PLOVDIV, BULGARIA

FONDERIE
EDITIONS TECHNIQUES DES INDUSTRIES
DE LA FONDERIE
12, AVE RAPHAEL
PARIS, FRANCE

FOOD AND COSMETICS TOXICOLOGY
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

FOOD ENGINEERING
CHILTON COMPANY
CHESTNUT AND 56TH STREETS
PHILADELPHIA, PA. 19139

FOREST SCIENCE
SOCIETY OF AMERICAN FORESTERS
1010 16TH STREET, N.W.
WASHINGTON, D.C. 20036

FORTSCHRITTE AUF DEM GEBIETE DER ROENTGENSTRAHLEN
UND DER NUKLEARMEDIZIN
GEORG THIEME VERLAG
HERDWEG 63
7000 STUTTGART 1, GERMANY

FORTSCHRITTE DER MEDIZIN
DR. SCHWAPPACH UND COMPANY
WESSOBRUNNER STR. 4
MUNICH, GERMANY

FOUNDRY
PENTON PUBLISHING COMPANY
PENTON BUILDING
1213 W. 3RD STREET
CLEVELAND, OHIO 44113

FOUNDRY TRADE JOURNAL (LONDON)
FUEL AND METALLURGICAL JOURNALS LTD.
17 JOHN ADAMS STREET
ADELPHI, LONDON, WC2, ENGLAND

FREIBERGER FORSCHUNGSHEFTE, REIHE A
VEB DEUTSCHER VERLAG FUER
GRUNDSTOFFINDUSTRIE
KARL-HEINE-STR. 27
7031 LEIPZIG, E. GERMANY

FRESENIUS' ZEITSCHRIFT FUER ANALYTISCHE CHEMIE
SPRINGER-VERLAG
HEIDELBERGER PL. 3
1 BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

FRIULI MEDICO
TIPOGRAFIA AGOSTINO PELLEGRINI
VIA DELLA VIGNA, 24/1
UDINE, ITALY

FRONTIER
IIT RESEARCH INSTITUTE
10 W. 35TH STREET
CHICAGO, ILL. 60616

FRONTIERS OF PLANT SCIENCE
CONNECTICUT AGRICULTURAL EXPERIMENT
STATION
NEW HAVEN, CONN. 06504

FUEL
BUTTERWORTH AND COMPANY (PUBLISHERS) LTD.
88 KINGSWAY
LONDON WC2, ENGLAND

FUEL ABSTRACTS
INSTITUTE OF FUEL
18 DEVONSHIRE STREET
LONDON, W1N 2AU, ENGLAND

FUEL OIL AND OIL HEAT
HEATING PUBLISHERS, INC.
447 ORANGE ROAD
MONTCLAIR, N.J. 07042

FUNTAI KOGAKU (POWDER ENGINEERING)
1-6, KANDA IZUMI-CHO
CHIYODA-KU, TOKYO, JAPAN

FUNTAI KOGAKU KENKYUKAI-SHI (JOURNAL OF RESEARCH
ASSOCIATION POWDER TECHNOLOGY)
NAGOYA GIJUTSU SHIKENJO I
HIRATE-CHO
KITAKU, NAGOYA, JAPAN

GAS AND OIL POWER
WHITEHALL TECHNICAL PRESS LTD.
WROTHAM PLACE
SEVENOAKS, ENGLAND

GAS TURBINE INTERNATIONAL
GAS TURBINE PUBLICATIONS, INC.
80 LINCOLN AVENUE
STAMFORD, CONN. 06904

GAS WAERME INTERNATIONAL
VULKAN-VERLAG DR. W. CLASSEN
POSTFACH 1015
43 ESSEN, GERMANY

GAS WASSER, WAERME
OESTERREICHISCHE VEREINIGUNG FUER
DAS GAS- UND WASSFACH
GUSSHAUSSTR 30
1041 VIENNA, AUSTRIA

GAS- UND WASSERFACH (G.W.F.)
R. OLDENBOURG VERLAG
ROSENHEIMER STR. 145
8000 MUNICH 80, GERMANY

GAS WORLD
BENN BROTHERS LTD.
BOUVERIE HOUSE
FLEET STREET
LONDON EC4, ENGLAND

GAZ, WODA I TECHNIKA SANITARNA
RUCH
UL WRONIA 23
WARSAW 1, POLAND

GAZETTE MEDICALE DE FRANCE
GAZETTE MEDICALE DE FRANCE
33 AVENUE MOZART
75 PARIS 16E, FRANCE

GENSHIRYOKU KOGYO (NUCLEAR ENGINEERING)
NIKKAN KOGYO SHINBUN-SHA
1-1, IIDA-MACHI,
CHIYSDA-KU, TOKYO, JAPAN

GEOCHIMICA ET COSMOCHIMICA ACTA
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

GEOGRAPHICAL REVIEW
AMERICAN GEOGRAPHICAL SOCIETY
BROADWAY AT 156TH STREET
NEW YORK, N.Y. 10032

GEOPHYSICS
SOCIETY OF EXPLORATION GEOPHYSICSTS
BOX 3098
TULSA, OKLAHOMA 74101

GESUNDHEITS-INGENIEUR
R. OLDENBOURG VERLAG
ROSENHEIMER STR. 145
8000 MUNICH 80, GERMANY

GESUNDHEITSWESEN UND DESINFEKTION
MEDIZINISCH-LITERARISCHER
VERLAG RINGSTR. 4
311 UELZEN, WEST GERMANY

GIDROKHIMICHESKIE MATERIALY
V.G. DATSKO
HYDROCHEMICAL INSTITUT
NOVOCHERKASSK MOSKOVSKAYA
MOSCOW U.S.S.R.

GIESSEREI
GIESSERI-VERLAG GMBH
POSTFACH 3503
4 DUESSELDORF, GERMANY

GIESSEREIPRAXIS
FACHVERLAG SCHIELE UND SCHOEN GMBH
MARKGRAFENSTR 11
1 BERLIN, GERMANY

GIESSEREITECHNIK
VEB DEUTSCHER VERLAG FUER
GRUNDSTOFFINDUSTRIE
KARL-HEINE-STR. 27
7031 LEIPZIG, E. GERMANY

GIGIENA I SANITARIIA
MEZHDUNARODNAYA KNIGA
MOSCOW G-200
U.S.S.R.

GIGIENA TRUDA I PROFESSIONAL'NYE ZABOLEVANIYA
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

GIORNALE DE CLINICA MEDICA (BOLOGNA)
PROF. D. CAMPANACCI,
VIA GUALANDI, 1
40136 BOLOGNA, ITALY

GIORNALE DI IGIENE E MEDICINA PREVENTIVA (GENOVA)
ISTITUTO DI IGIENE, UNIVERSITA
VIA A. PASTORE, 1
GENOA, ITALY

GLUECKAUF
VERLAG GLUECKAUF GMBH
POSTFACH 1794
4300 ESSEN, GERMANY
U.S. ADDRESS
STECHERT-HAFNER SERVICE AGENCY INC.
31 E. 10TH STREET
NEW YORK, N.Y. 10003

GOVERNMENT REPORTS ANNOUNCEMENTS
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22151

GRANA
ALMQVIST AND WIKSELL PERIODICAL COMPANY
GAMLA BROGATAN 26
P.O. BOX 62
S-101 20 STOCKHOLM 1
SWEDEN

GRAPHIC ARTS ABSTRACTS
GRAPHIC ARTS TECHNICAL FOUNDATION
4615 FORBES AVENUE
PITTSBURGH, PA. 15213

GRAPHIC ARTS PROGRESS
GRAPHIC ARTS INFORMATION SERVICE
ROCHESTER INSTITUTE OF TECHNOLOGY
65 PLYMOUTH AVENUE, S.
ROCHESTER, N.Y. 14608

GRUZLICA I CHOROBY PLUC
RUCH
UL WRONIA 23
WARSAW 1, POLAND

H.S.M.H.A. HEALTH REPORTS
SUPERINTENDENT OF DOCUMENTS
U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C. 20402

HARVARD BUSINESS REVIEW
EDWARD C. BURSK, EDITOR
HARVARD UNIVERSITY GRADUATE SCHOOL OF
BUSINESS ADMINISTRATION
SOLDIERS FIELD
BOSTON, MASS. 02163

HAWAII MEDICAL JOURNAL
HAWAII MEDICAL ASSOCIATION
510 S. BERETANIA STREET
HONOLULU, HAWAII 96813

HEALTH LABORATORY SCIENCE
AMERICAN PUBLIC HEALTH ASSOCIATION INC.
49 SHERIDAN AVENUE
ALBANY, N.Y. 12210

HEALTH PHYSICS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

HEATING, PIPING, AND AIR CONDITIONING
VAN NOSTRAND-REINHOLD COMPANY INC.
120 ALEXANDER STREET
PRINCETON, N.J. 08540

HEATING AND VENTILATING ENGINEER AND JOURNAL OF AIR CONDITIONING
TECHNITRADE JOURNALS LTD.
11-13 SOUTHAMPTON ROW
LONDON WC1, ENGLAND

HIGH TEMPERATURE
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

HIGIJENA (BELGRADE)
JUGOSLOVENSKA KNJIGA
TERAZIJE 27/11
BELGRADE, YUGOSLAVIA

HISPALIS MEDICA
HISPALIS MEDICA
PASTOR Y LANDERO
13, SEVILLE, SPAIN

HORTICULTURE
MASSACHUSETTS HORTICULTURAL SOCIETY
HORTICULTURAL HALL
300 MASSACHUSETTS AVE.
BOSTON, MASS. 02115

HOSPITALS
AMERICAN HOSPITAL ASSOCIATION
840 N. LAKE SHORE DRIVE
CHICAGO, ILL. 60611

LA HOUILLE BLANCHE
LA HOUILLE BLANCHE
P.O. BOX 41
GRENOBLE, FRANCE

HUMAN PATHOLOGY
W.B. SAUNDERS COMPANY
WEST WASHINGTON SQUARE
PHILADELPHIA, PA. 19105

HUTNICKE LISTY
SNTL-STATNI NAKLADATELSTVI TECHNICKE LITERATURY
SPALENA 51
PRAGUE 1, CZECHOSLOVAKIA

HYDROCARBON NEWS
PETROLEUM ENGINEER PUBLISING COMPANY
800 DAVIS BUILDING, BOX 1589
DALLAS, TEXAS, 75202

HYDROCARBON PROCESSING
GULF PUBLISHING COMPANY
CIRCULATION MANAGER
P.O. BOX 2608
HOUSTON, TEXAS 77001

I.E.E.E. SPECTRUM
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
345 E. 47TH STREET
NEW YORK, N.Y. 10017

I.E.E.E. TRANSACTIONS, NUCLEAR SCIENCE
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
345 E. 47TH STREET
NEW YORK, N.Y. 10017

I.S.A. TRANSACTIONS (INSTRUMENT SOCIETY OF AMERICA)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

IDOJARAS (BUDAPEST)
KULTURA
P.O. BOX 149
BUDAPEST 62, HUNGARY

IGAKU TO SEIBUTSUGAKU (MEDICINE AND BIOLOGY)
IGAKU SEIBUTSUGAKU SOKUHOKAI
OGATA IGAKU KAGAKU KENKYUSHO
1-11(4) HIGASHI-KANDA
CHIYODA, TOKYO, JAPAN

IGIENA (BUCHAREST)
CARTIMEX
CASUTA POSTALA 134-136
BUCHAREST, ROMANIA

L'IGIENE MODERNA
ISTITUTO DI MICROBIOLOGIA
OSPEDALE MAGGIORE
PARMA, ITALY
U.S. ADDRESS
STECHERT-HAFNER SERVICE AGENCY INC.
31 E. 10TH STREET
NEW YORK, N.Y. 10003

IGIENE E SANITA PUBBLICA (ROME)
IGIENE E SANITA PUBBLICA
VIA STAMIRA, 7
00162 ROME, ITALY

IMONU
JAPAN PUBLICATIONS TRADING CO., LTD.
BOX 5030, TOKYO INTERNATIONAL
TOKYO, JAPAN

INDEX MEDICUS
NATIONAL LIBRARY OF MEDICINE
8600 ROCKVILLE PARK
BETHESDA, MD. 20014

INDIAN AND EASTERN ENGINEER
SOHRAB HOUSE
235 DR. D. NAOROJI ROAD
BOMBAY, INDIA

INDIAN JOURNAL OF CANCER (BOMBAY)
DR. D.J. JUSSAWALLA
HOSPITAL AVENUE
PAREL, BOMBAY, INDIA

INDIAN JOURNAL OF MEDICAL RESEARCH
INDIAN COUNCIL OF MEDICAL RESEARCH
HEADQUARTER BUILDING
P.O. BOX 494
NEW DELHI, INDIA

INDIAN JOURNAL OF PURE AND APPLIED PHYSICS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

INDUSTRIAL DEVELOPMENT AND MANUFACTURERS RECORD
CONWAY PUBLICATIONS, INC.
2600 APPLE VALLEY ROAD
ATLANTA, GA. 30319

INDUSTRIAL ENGINEERING CHEMISTRY FUNDAMENTALS
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

INDUSTRIAL AND ENGINEERING CHEMISTRY, PROCESS DESIGN AND DEVELOPMENT
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

INDUSTRIAL AND ENGINEERING CHEMISTRY, PRODUCT
RESEARCH AND DEVELOPMENT
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

INDUSTRIAL GAS
MOORE PUBLISHING COMPANY
OJIBWAY BUILDING
DULUTH, MINN. 55802

INDUSTRIAL HEATING
NATIONAL INDUSTRIAL PUBLISHING COMPANY
1400 UNION TRUST BUILDING
PITTSBURGH, PA. 15219

INDUSTRIAL LABORATORY (U.S.S.R.) (ENGLISH
TRANSLATION OF ZAVODSKAYA LABORATORIYA)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

INDUSTRIAL MEDICINE AND SURGERY
INDUSTRIAL MEDICINE AND SURGERY
BOX 546, KENDALL STATION
MIAMI, FLORIDA 33156

INDUSTRIE CHIMIQUE BELGE
INDUSTRIE CHIMIQUE BELGE
49 SQUARE, MARIE-LOUISE
BRUSSELS 4, BELGIUM

INDUSTRY WEEK
CHI-INI LTD.
161-166 FLEET STREET
LONDON E.C.4, ENGLAND

INFRARED PHYSICS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

INGEGNERE (MILAN)
INSTITUTO PROPAGANDA INTERNAZIONALE
VIA FRIULA, 32
MILAN, ITALY

INGEGNERIA
EDITORE ULRICO HOEPLI
VIA GAROFALO 19
MILAN, ITALY

INGEGNERIA SANITARIA
ISTITUTO PROPAGANDA INTERNAZIONALE
VIA FRIULI 32
20135 MILAN, ITALY

LA INGENIERIA
GUMERSINDO GARCIA, SA
GENERAL MARTINEZ CAMPOS
3, MADRID, SPAIN

INGENIERIA QUIMICA (MEXICO)
EDITORIAL COSMOS
BAJIO 335, DESP 603
MEXICO CITY, MEXICO

INGENIEUR (CANADA)
ASSOCIATION DES DIPLOMES DE POLYTECHNIQUES
2500 AVENUE MARIE-GUYARD
MONTREAL 250, CANADA

INGENIEURS (GHENT)
NATIONALE UNIE DER TECHNISCH
INGENIEURS
36 SAVAANSTR.
GHENT, BELGIUM

INGENIEURS DE L'AUTOMOBILE
INGENIEURS DE L'AUTOMOBILE
254, RUE DE VAUGIRARD
PARIS, FRANCE

INORGANIC CHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

INQUINAMENTO
CASA EDITRICE ETAS-KOMPAS
VIA MANTEGNA 6
MILAN, ITALY

INSTITUTION OF MINING AND METALLURGY BULLETIN
AND TRANSACTIONS
INSTITUTION OF MINING AND METALLURGY
44 PORTLAND PLACE
LONDON, ENGLAND

INSTRUMENT PRACTICE
UNITED TRADE PRESS LTD.
9 GOUGH SQUARE, FLEET STREET
LONDON, ENGLAND

INSTRUMENTATION
HONEYWELL INC.
INDUSTRIAL DIVISION
FORT WASHINGTON, PA. 19034

INSTRUMENTATION TECHNOLOGY
INSTRUMENTATION TECHNOLOGY
530 WILLIAM PENN PLACE
PITTSBURGH, PA. 15219

INSTRUMENTS AND CONTROL SYSTEMS
RIMBACH PUBLICATIONS
56TH AND CHESTNUT STREETS
PHILADELPHIA, PA. 19139

INTERNATIONAL ARCHIVES OF ALLERGY AND APPLIED
IMMUNOLOGY
S. KARGER AG
ARNOLD-BOECKLIN-STR. 25
CH 4000 BASEL 11
SWITZERLAND

INTERNATIONAL CHEMICAL ENGINEERING
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

INTERNATIONAL DIGEST OF HEALTH LEGISLATION
WORLD HEALTH ORGANIZATION
DISTRIBUTION AND SALES UNIT
GENEVA, SWITZERLAND

INTERNATIONAL JOURNAL OF APPLIED RADIATION AND
ISOTOPES
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

INTERNATIONAL JOURNAL OF BIOMETEOROLOGY
INTERNATIONAL JOURNAL OF BIOMETEOROLOGY
HOFBROUCKERLAAN 54
OEGSTGEEST, LEIDEN, NETHERLANDS

INTERNATIONAL JOURNAL FOR RADIATION PHYSICS AND
CHEMISTRY
PERGAMON PRESS
MAXWELL HOUSE
FAIRVIEW PARK
ELMSFORD, N.Y. 10523

INTERNATIONALE ZEITSCHRIFT FUER ANGEWANDTE
PHYSIOLOGIE EINSCHLIESSLICH ARBEITSPHYSIOLOGIE
SPRINGER-VERLAG
HEIDELBERGER PL. 3
1 BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

INTERNATIONALES ARCHIV FUER ARBEITSMEDIZIN
SPRINGER-VERLAG
HEIDELBERGER PL. 3
1 BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

INZHENERNO-FIZICHESKII ZHURNAL
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ION
ION
SAN BERNARDO, 62
MADRID, SPAIN

IRISH JOURNAL OF MEDICAL SCIENCE
ROYAL ACADEMY OF MEDICINE
6 KILLARE STREET
DUBLIN, IRELAND

IRISH NATURALISTS' JOURNAL
DR. C. LOGAN
PLANT PATHOLOGY FIELD STATION
NEWFORGE LANE
BELFAST, IRELAND

IRON AGE
CHILTON COMPANY
CHESTNUT AND 56TH STREETS
PHILADELPHIA, PA. 19139

IRON AND STEEL
ILIFFE INDUSTRIAL PUBLICATIONS LTD.
DORSET HOUSE, STAMFORD STREET
LONDON SE1, ENGLAND

IRON AND STEEL ENGINEER
ASSOCIATION OF IRON AND STEEL ENGINEERS
20TH AND NORTHAMPTON STREETS
EASTON, PA. 18042

ISOTOPES AND RADIATION TECHNOLOGY
SUPERINTENDENT OF DOCUMENTS
U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C. 20402

ISRAEL JOURNAL OF CHEMISTRY
WEIZMANN SCIENCE PRESS
P.O. BOX 801
JERUSALEM, ISRAEL
OR
WILLIAM DAWSON AND SONS LTD.
CANNON HOUSE, MACKLIN STREET
LONDON, ENGLAND

ISRAEL JOURNAL OF MEDICAL SCIENCES
ISRAEL JOURNAL OF MEDICAL SCIENCES
P.O. BOX 2296
JERUSALEM, ISRAEL
U.S. ADDRESS
THE INTERCONTINENTAL MEDICAL BOOK CORPORATION
381 PARK AVENUE, S.
NEW YORK, N.Y. 10016

IZVESTIYA AKADEMII NAUK S.S.S.R. SERIYA
KHIMICHESKAYA
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

IZVESTIIA VYSSHIKH UCHEBNYKH ZAVEDENII, ENERGETIKA
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

JAPANESE HEART JOURNAL
NANKODO COMPANY LTD.
42-6, HONGO 3-CHOME
BUNKYO-KU, TOKYO, JAPAN

JAPANESE JOURNAL OF APPLIED PHYSICS
JUNPEI TSUJIUCHI, ED.
ROOM 211, KIKAI SHINKO BLDG.
21 SHIBA KOEN MINATO-KU
TOKYO 105 JAPAN

JAPANESE JOURNAL OF HYGIENE (TOKYO)
NIPPON EISEI GAKKAI
KEIO DAIGAKU IGAKUBU EISEIGAKU
KOSHU EISEIGAKU KYOSHITSU
35, SHINANO-MACHI
SHINJUKU-KU, TOKYO, JAPAN

JAPANESE JOURNAL OF LEGAL MEDICINE (TOKYO)
MEDICO-LEGAL SOCIETY OF JAPAN
TOKYO DAIGAKU IGAKUBU HOIGAKU
KYOSHITSU
7-3-1, HONGO
BUNKYO-KU, TOKYO, JAPAN

JAPANESE JOURNAL OF PHYSIOLOGY (KYOTO)
DR. YAS KUNO
KAMIGORYO-MAE NISHIJIN
KYOTO, JAPAN

JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF AEROSOL SCIENCE
PERGAMON PRESS
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

JOURNAL OF AGRICULTURAL ENGINEERING RESEARCH
ACADEMIC PRESS INC.
BERKELEY SQUARE HOUSE, BERKELEY SQUARE
LONDON W1, ENGLAND
U.S. ADDRESS
ACADEMIC PRESS INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF THE AIR POLLUTION CONTROL ASSOCIATION
AIR POLLUTION CONTROL ASSOCIATION
4400 FIFTH AVENUE
PITTSBURGH, PA. 15213

JOURNAL OF AIRCRAFT
AMERICAN INSTITUTE OF AERONAUTICS
AND ASTRONAUTICS INC.
1290 AVENUE OF THE AMERICAS
NEW YORK, N.Y. 10019

JOURNAL OF THE ALBERT EINSTEIN MEDICAL CENTER
ALBERT EINSTEIN MEDICAL CENTER
YORK AND TABOR ROADS
PHILADELPHIA, PA. 19141

JOURNAL OF ALLERGY
C.V. MOSBY COMPANY
3207 WASHINGTON BOULEVARD
ST. LOUIS, MO. 63103

JOURNAL OF THE AMERICAN CERAMIC SOCIETY
AMERICAN CERAMIC SOCIETY
4055 N. HIGH STREET
COLUMBUS, OHIO 43214

JOURNAL OF THE AMERICAN CHEMICAL SOCIETY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION
AMERICAN MEDICAL ASSOCIATION
535 N. DEARBORN STREET
CHICAGO, ILL. 60610

JOURNAL OF THE AMERICAN OIL CHEMISTS' SOCIETY
AMERICAN OIL CHEMISTS' SOCIETY
35 E. WACKER DRIVE
CHICAGO, ILL. 60601

JOURNAL OF THE AMERICAN OSTEOPATHIC ASSOCIATION
AMERICAN OSTEOPATHIC ASSOCIATION
212 E. OHIO STREET
CHICAGO, ILL. 60611

JOURNAL OF ANALYTICAL CHEMISTRY OF THE U.S.S.R.
(ENGLISH TRANSLATION OF ZHURNAL ANALITICHESKOI
KHIMII)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

Reproduced from
best available copy.

JOURNAL OF APPLIED BACTERIOLOGY
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

JOURNAL OF APPLIED CHEMISTRY
SOCIETY OF CHEMICAL INDUSTRY
14 BELGRAVE SQUARE
LONDON SW1, ENGLAND

JOURNAL OF APPLIED CHEMISTRY OF THE U.S.S.R.
(ENGLISH TRANSLATION OF ZHURNAL PRIKLADNOI
KHIMII)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

JOURNAL OF APPLIED MECHANICS (AMERICAN SOCIETY OF
MECHANICAL ENGINEERS TRANSACTIONS)
AMERICAN SOCIETY OF MECHANICAL
ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF APPLIED METEOROLOGY
AMERICAN METEOROLOGICAL SOCIETY
45 BEACON STREET
BOSTON, MASS. 02108

JOURNAL OF APPLIED PHYSICS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF APPLIED PHYSIOLOGY
AMERICAN PHYSIOLOGICAL SOCIETY
9650 ROCKVILLE PIKE
BETHESDA, MD. 20014

JOURNAL OF THE ARKANSAS MEDICAL SOCIETY
ARKANSAS MEDICAL SOCIETY
215 KELLEY BUILDING
FORT SMITH, ARKANSAS 72901

JOURNAL OF ASTHMA RESEARCH
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

JOURNAL OF THE ATMOSPHERIC SCIENCES
AMERICAN METEOROLOGICAL SOCIETY
45 BEACON STREET
BOSTON, MASS. 02108

JOURNAL OF ATMOSPHERIC AND TERRESTRIAL PHYSICS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

JOURNAL OF BASIC ENGINEERING (AMERICAN SOCIETY OF
OF MECHANICAL ENGINEERS TRANSACTIONS)
AMERICAN SOCIETY OF MECHANICAL
ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF BIOLOGICAL CHEMISTRY
AMERICAN SOCIETY OF BIOLOGICAL
CHEMISTS, INC.
MOUNT ROYAL AND GUILFORD AVENUES
BALTIMORE, MD. 21202

JOURNAL OF THE CANADIAN CERAMIC SOCIETY
CANADIAN CERAMIC SOCIETY
SUITE 715, 159 BAY STREET
TORONTO, ONT. CANADA

JOURNAL OF CATALYSIS
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

JOURNAL OF CHEMICAL DOCUMENTATION
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF CHEMICAL EDUCATION
AMERICAN CHEMICAL SOCIETY
DIVISION OF CHEMICAL EDUCATION
20TH AND NORTHAMPTON STREETS
EASTON, PA. 18042

JOURNAL OF CHEMICAL AND ENGINEERING DATA
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF CHEMICAL PHYSICS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF CHROMATOGRAPHIC SCIENCE
PRESTON TECHNICAL ABSTRACTS COMPANY
2101 DEMPSTER STREET
EVANSTON, ILL. 60201

JOURNAL OF CHROMATOGRAPHY
AMERICAN ELSEVIER PUBLISHING COMPANY INC.
52 VANDERBILT AVENUE
NEW YORK, N.Y. 10017

JOURNAL OF CHRONIC DISEASES
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

JOURNAL OF CLINICAL ENDOCRINOLOGY AND METABOLISM
J.B. LIPPINCOTT COMPANY
227 S. 6TH STREET
PHILADELPHIA, PA. 19106

JOURNAL OF CLINICAL INVESTIGATION
ROCKEFELLER UNIVERSITY PRESS
P.O. BOX 5106
CHURCH STREET STATION
NEW YORK, N.Y. 10021

JOURNAL OF CLINICAL PATHOLOGY
BRITISH MEDICAL ASSOCIATION
TAVISTOCK SQUARE
LONDON, ENGLAND

JOURNAL OF COATED FIBROUS MATERIALS
TECHNOMIC PUBLISHING COMPANY
265 W. STATE STREET
WESTPORT, CONN. 06880

JOURNAL OF COLLOID AND INTERFACE SCIENCE
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

JOURNAL OF DYNAMIC SYSTEMS, MEASUREMENT, AND CONTROL
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF ECONOMIC ENTOMOLOGY
ENTOMOLOGICAL SOCIETY OF AMERICA
531 W. PRATT STREET
BALTIMORE, MD. 21201

JOURNAL OF ENGINEERING FOR INDUSTRY (AMERICAN
SOCIETY OF MECHANICAL ENGINEERS TRANSACTIONS)
AMERICAN SOCIETY OF MECHANICAL
ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF ENGINEERING FOR POWER (AMERICAN SOCIETY
OF MECHANICAL ENGINEERS TRANSACTIONS)
AMERICAN SOCIETY OF MECHANICAL
ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF ENVIRONMENTAL HEALTH
NATIONAL ASSOCIATION OF SANITARIANS
LINCOLN BUILDING
1550 LINCOLN STREET
DENVER, COLO. 80203

JOURNAL OF ENVIRONMENTAL QUALITY
AMERICAN SOCIETY OF AGRONOMY
677 S. SEGOE ROAD
MADISON, WIS. 53711

JOURNAL OF ENVIRONMENTAL SCIENCES
INSTITUTE OF ENVIRONMENTAL SCIENCES
940 E. NORTHWEST HIGHWAY
MT. PROSPECT, ILL. 60056

JOURNAL OF FIRE AND FLAMMABILITY
TECHNOMIC PUBLISHING CO., INC.
750 SUMMER STREET
STAMFORD, CONN. 06901

JOURNAL OF FLUID MECHANICS
CAMBRIDGE UNIVERSITY PRESS
BENTLEY HOUSE, 200 EUSTON ROAD
LONDON NW1, ENGLAND
U.S. ADDRESS
CAMBRIDGE UNIVERSITY PRESS
32 E. 57TH STREET
NEW YORK, N.Y. 10022

JOURNAL OF FORENSIC SCIENCES
CALLAGHAN AND COMPANY
165 N. ARCHER AVENUE
MUNDELEIN, ILL. 60060

JOURNAL OF FORESTRY
SOCIETY OF AMERICAN FORESTERS
1010 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF FUEL AND HEAT TECHNOLOGY
TURRET PRESS LTD.
65-66 TURNMILL STREET
LONDON E.C.1, ENGLAND

JOURNAL OF GEOPHYSICAL RESEARCH
AMERICAN GEOPHYSICAL UNION
SUITE 435
2100 PENNSYLVANIA AVENUE, N.W.
WASHINGTON, D.C. 20037

JOURNAL OF HEALTH AND SOCIAL BEHAVIOR
AMERICAN SOCIOLOGICAL ASSOCIATION
1001 CONNECTICUT AVENUE, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF HEAT TRANSFER (AMERICAN SOCIETY OF MECHANICAL ENGINEERS TRANSACTIONS)
AMERICAN SOCIETY OF MECHANICAL
ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF HISTOCHEMISTRY AND CYTOCHEMISTRY
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

JOURNAL OF HYGIENE
CAMBRIDGE UNIVERSITY PRESS
BENTLEY HOUSE, 200 EUSTON ROAD
LONDON NW1, ENGLAND
U.S. ADDRESS
CAMBRIDGE UNIVERSITY PRESS
32 E. 57TH STREET
NEW YORK, N.Y. 10022

JOURNAL OF HYGIENE, EPIDEMIOLOGY, MICROBIOLOGY, AND IMMUNOLOGY (PRAGUE)
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

JOURNAL OF IMMUNOLOGY
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

JOURNAL OF THE INDIAN MEDICAL ASSOCIATION
INDIAN MEDICAL ASSOCIATION
23, SAMAVAYA MANSIONS
CORPORATION PLACE
CALCUTTA, INDIA

JOURNAL OF INFECTIOUS DISEASES
UNIVERSITY OF CHICAGO PRESS
5750 ELLIS AVENUE
CHICAGO, ILL. 60637

JOURNAL OF THE INSTITUTE OF FUEL
INSTITUTE OF FUEL
18 DEVONSHIRE STREET
PORTLAND PLACE
LONDON, ENGLAND

JOURNAL OF THE INSTITUTE OF PETROLEUM
INSTITUTE OF PETROLEUM
61 NEW CAVENDISH STREET
LONDON, ENGLAND

JOURNAL OF THE INSTITUTION OF HEATING AND VENTILATING ENGINEERS
INSTITUTION OF HEATING AND
VENTILATING ENGINEERS
49 CADOGAN SQUARE
LONDON, ENGLAND

JOURNAL OF THE IOWA MEDICAL SOCIETY
IOWA MEDICAL SOCIETY
1001 GRANT STREET
FULTON, IOWA 50265

JOURNAL OF THE IRON AND STEEL INSTITUTE (LONDON)
THE IRON AND STEEL INSTITUTE
4 GROSVENOR GARDENS
LONDON, ENGLAND

JOURNAL OF THE JAPAN SOCIETY OF MECHANICAL ENGINEERS (NIPPON KIKAI GAKKAI SHI)
JAPAN PUBLICATIONS TRADING COMPANY, LTD.
BOX 5030, TOKYO INTERNATIONAL
TOKYO, JAPAN

JOURNAL OF LAND AND PUBLIC UTILITY ECONOMICS (NAME VARIES - LAND ECONOMICS)
UNIVERSITY OF WISCONSIN
SOCIAL SCIENCE BUILDING
MADISON, WIS. 53706

JOURNAL OF LIPID RESEARCH
ROCKEFELLER UNIVERSITY
NEW YORK, N.Y. 10021

JOURNAL OF THE LOUISIANA STATE MEDICAL SOCIETY
LOUISIANA STATE MEDICAL SOCIETY
1430 TULANE AVENUE
NEW ORLEANS, LA. 70112

JOURNAL OF MECHANICAL ENGINEERING SCIENCE
INSTITUTION OF MECHANICAL ENGINEERS
1 BIRDCAGE WALK
WESTMINSTER, LONDON, SW1, ENGLAND

JOURNAL OF METALS
AMERICAN INSTITUTE OF MINING, METALLURGICAL
AND PETROLEUM ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF THE METEOROLOGICAL SOCIETY OF JAPAN (KISHO SHUSHI)
JAPAN PUBLICATIONS TRADING COMPANY, LTD.
BOX 5030, TOKYO INTERNATIONAL
TOKYO, JAPAN

JOURNAL OF MILK AND FOOD TECHNOLOGY
H.L. THOMASSON, MANAGING EDITOR
P.O. BOX 437
SHELBYVILLE, IND. 46176

JOURNAL OF MINES, METALS AND FUELS
JOURNAL OF MINES, METALS AND FUELS
6/2 MADAN STREET
CALCUTTA, INDIA

JOURNAL OF MOLECULAR STRUCTURE
ELSEVIER PUBLISHING COMPANY
SPUISTRAAT 110-112
AMSTERDAM, NETHERLANDS
U.S. ADDRESS
AMERICAN ELSEVIER PUBLISHING COMPANY, INC.
52 VANDERBILT AVENUE
NEW YORK, N.Y. 10017

JOURNAL OF THE NATIONAL CANCER INSTITUTE (NATIONAL INSTITUTES OF HEALTH, PUBLIC HEALTH SERVICE)
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

JOURNAL OF NEUROLOGY, NEUROSURGERY AND PSYCHIATRY
B.M.A. HOUSE
TAVISTOCK SQUARE
LONDON, ENGLAND
U.S. ADDRESS
B.M.A. HOUSE
80 BRIGHTON AVENUE
BOSTON, MASS. 02134

JOURNAL OF OCCUPATIONAL MEDICINE
CHARLES B. SLACK INC.
325 S. BROADWAY
PITMAN, N.J. 08071

JOURNAL OF THE OIL AND COLOUR CHEMISTS' ASSOCIATION
OIL AND COLOUR CHEMISTS' ASSOCIATION
WAX CHANDLERS' HALL
GRESHAM STREET
LONDON, ENGLAND

JOURNAL OF THE OPTICAL SOCIETY OF AMERICA
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF ORGANIC CHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF PAINT TECHNOLOGY
FEDERATION OF SOCIETIES FOR PAINT
TECHNOLOGY
121 S. BROAD STREET
PHILADELPHIA, PA. 19107

JOURNAL OF PATHOLOGY
OLIVER AND BOYD LTD.
TWEEDDALE COURT
14 HIGH STREET
EDINBURGH, SCOTLAND

JOURNAL OF PETROLEUM TECHNOLOGY
SOCIETY OF PETROLEUM ENGINEERS OF AIME
6300 N. CENTRAL EXPRESSWAY
DALLAS, TEXAS 75206

JOURNAL OF PHARMACOLOGY AND EXPERIMENTAL
THERAPEUTICS
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

JOURNAL OF PHYSICAL CHEMISTRY
AMERICAN CHEMICAL SOCIETY
1155 16TH STREET, N.W.
WASHINGTON, D.C. 20036

JOURNAL OF PHYSICS A - GENERAL PHYSICS
INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY
47 BELGRAVE SQUARE
LONDON S.W. 1, ENGLAND
U.S. ADDRESS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF PHYSICS B - ATOMIC AND MOLECULAR PHYSICS
INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY
47 BELGRAVE SQUARE
LONDON S.W. 1, ENGLAND
U.S. ADDRESS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF PHYSICS C - SOLID STATE PHYSICS
INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY
47 BELGRAVE SQUARE
LONDON S.W. 1, ENGLAND
U.S. ADDRESS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF PHYSICS D - APPLIED PHYSICS
INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY
47 BELGRAVE SQUARE
LONDON S.W. 1, ENGLAND
U.S. ADDRESS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF PHYSICS E - SCIENTIFIC INSTRUMENTS
INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY
47 BELGRAVE SQUARE
LONDON S.W. 1, ENGLAND
U.S. ADDRESS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF PHYSICS F - METAL PHYSICS
INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY
47 BELGRAVE SQUARE
LONDON S.W. 1, ENGLAND
U.S. ADDRESS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF POLYMER SCIENCE (SECTIONS; A - GENERAL
PAPERS, CHEMISTRY; A2 - GENERAL PAPERS, PHYSICS;
B - GENERAL LETTERS; C - POLYMER SYMPOSIA)
INTERSCIENCE PUBLISHERS
JOHN WILEY AND SONS, INC.
605 THIRD AVENUE
NEW YORK, N.Y. 10016

JOURNAL OF QUANTITATIVE SPECTROSCOPY AND
RADIATIVE TRANSFER
PERGAMON PRESS, INC.
JOURNALS DEPARTMENT
MAXWELL HOUSE
FAIRVIEW PARK
ELMSFORD, N.Y. 10523

JOURNAL DE RECHERCHES ATMOSPHERIQUES
UNIVERSITES DE CLERMONT-FERRAND ET TOULOUSE
INSTITUTE ET OBSERVATOIRE DU PUY DE DOME
12, AVE DES LANDAIS
63 CLERMONT-FERRAND, FRANCE

JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF
STANDARDS (A) PHYSICS AND CHEMISTRY,
(B) MATHEMATICS AND MATHEMATICAL PHYSICS,
(C) ENGINEERING AND INSTRUMENTATION
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY
ROYAL HORTICULTURAL SOCIETY
VINCENT SQUARE
LONDON, ENGLAND

JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY
ROYAL METEOROLOGICAL SOCIETY
49 CROMWELL ROAD
LONDON S.W.7, ENGLAND

JOURNAL OF THE SANITARY ENGINEERING DIVISION
(PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL
ENGINEERS)
AMERICAN SOCIETY OF CIVIL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF THE SCIENCE OF FOOD AND AGRICULTURE
SOCIETY OF CHEMICAL INDUSTRY
14 BELGRAVE SQUARE
LONDON SW1, ENGLAND

JOURNAL OF THE SOCIETY OF COSMETIC CHEMISTS
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

JOURNAL OF SOIL AND WATER CONSERVATION
SOIL CONSERVATION SOCIETY OF AMERICA
7515 NORTHEAST ANKENY ROAD
ANKENY, IOWA 50021

JOURNAL OF SURGICAL RESEARCH
LITTLE, BROWN AND COMPANY
34 BEACON STREET
BOSTON, MASS. 02106

JOURNAL OF THE URBAN PLANNING AND DEVELOPMENT
DIVISION (PROCEEDINGS OF THE AMERICAN SOCIETY
OF CIVIL ENGINEERS)
AMERICAN SOCIETY OF CIVIL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION
WATER POLLUTION CONTROL FEDERATION
3900 WISCONSIN AVENUE
WASHINGTON, D.C. 20016

KAGAKU KOGAKU (CHEMICAL ENGINEERING)
SOCIETY OF CHEMICAL ENGINEERS, JAPAN
KOJUN BUILDING, 6-4, GINZA
CHUO-KU, TOKYO, JAPAN

KAGAKU KOGYO (CHEMICAL INDUSTRY) (TOKYO)
KAGAKU KOGYO-SHA
1-11, KANDA AWAJI-CHO
CHIYODA-KU, TOKYO, JAPAN

KAGAKU KOJO
1-1, IIDA-MACHI
CHIYODA-KU, TOKYO, JAPAN

KAMI PA GIKYOSHI (JOURNAL OF THE JAPANESE
TECHNICAL ASSOCIATION OF PULP AND PAPER
INDUSTRY)
KAMI PAUPU GIJUTSU KYOKAI
4 GINZA-HIGASHI 3-CHOME
CHUO-KU, TOKYO, JAPAN

KANAGAWA-KEN TAIKI USEN CHOSA KENKYU HOKOKU
KANAGAWA PREFECTURE AIR POLLUTION CONTROL
COMMITTEE
KANAGAWA-KEN KIKAKU CHOSA-KU KOGAI-KA
1, NIHON-ODORI NAKA-KU,
YOKOHAMA-SHI, KANAGAWA, JAPAN

KARYOKU HATSUDEN (THERMAL POWER)
SOCIETY OF THERMAL POWER ENGINEERS OF JAPAN
4-10, AKASAKA AOYAMA, KITA-MACHI
MINATO-KU, TOKYO, JAPAN

KEI-YU KANRI (JOURNAL OF INSTRUMENTATION CONTROL
ASSOCIATION OF JAPAN)
NIHON KEIRYO KAIKAN
25-1, NANDO-CHO
SHENJUKU-KU, TOKYO, JAPAN

KEMIJA U INDUSTRIJI
JUGOSLOVENSKA KNJIGA
TERAZIJE 27/11
BELGRADE, YUGOSLAVIA
OR
BERISLAVICEVA UL 6/1
ZAGREB, YUGOSLAVIA

KEMISK TIDSKRIFT
KEMISK TIDSKRIFT
P.O. BOX 841
10132 STOCKHOLM, SWEDEN

KERNTECHNIK
VERLAG KARL THIEMIG
PILGERSHEIMER STR 38
8 MUNICH, GERMANY

KHIMICHESKAYA PROMYSHLENOST (CHEMICAL INDUSTRY)
''KHIMIYA'', U. KRASNOSELSKAYA 37
MOSCOW B-66, U.S.S.R.

KINETICS AND CATALYSIS (U.S.S.R.) (ENGLISH
TRANSLATION OF KINETIKA I KATALIZ)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

KINETIKA I KATALIZ
CONSULTANTS BUREAU
227 W. 17TH STREET
NEW YORK, N.Y. 10011

KINZOKU (METALS)
AGUNE-SHA
10, ICHIBAN-CHO
CHIYODA-KU, TOKYO, JAPAN

KISHOCHO KENKYU JIHO (JOURNAL OF METEOROLOGICAL
RESEARCH)
KISHO-CHO
1-7, OTE-MACHI
CHIYODA-KU, TOKYO, JAPAN

KOGAI (POLLUTION CONTROL)
GOVERNMENT RESOURCES RESEARCH INSTITUTE
MINISTRY OF INTERNATIONAL TRADE & INDUSTRY
2-1-4, SOTO KANDA
CHIYODA-KU, TOKYO, JAPAN

KOGAI TO TAISAKU (JOURNAL OF POLLUTION CONTROL)
KOGAI TAISAKU GIJUTSU DOYUKAI
SANSHIN BLDG.
3-4, NIHONBASHI-DORI
CHUO-KU, TOKYO, JAPAN

KOGYO KAGAKU ZASSHI (JOURNAL OF THE CHEMICAL
SOCIETY OF JAPAN, INDUSTRIAL CHEMISTRY SECTION)
NIPPON KAGAKKAI
5, 1-CHOME, KANDA-SURUGADAI
CHIYODA-KU, TOKYO, JAPAN

KOKS I KHIMIYA (COKE AND CHEMISTRY)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

KOLLOIDNYI ZHURNAL (COLLOID JOURNAL)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

KOLLOID-ZEITSCHRIFT AND ZEITSCHRIFT FUER POLYMERE
DR. DIETRICH STEINKOPFF VERLAG
POSTFACH 1008
6100 DARMSTADT, GERMANY

KOSHU EISEIIN KENKYU HOKOKU (BULLETIN OF THE
INSTITUTE OF PUBLIC HEALTH, TOKYO)
KOKURITSU KOSHU EISEIIN
1, SHIROKANEDAIMACHI, SHIBA
MINATO-KU, TOKYO, JAPAN

KOSMOS (MOSCOW)
FRANCKH'SCHE VERLAGSHANDLUNG
W. KELLER AND COMPANY
KOSMOS-VERLAG, PFIZERSTR. 5-7
POSTFACH 640
7000 STUTTGART 1, W. GERMANY

KUKI CHOWA EISEI KAGAKU (JOURNAL OF THE SOCIETY
OF HEATING, AIR CONDITIONING AND SANITARY
ENGINEERS OF JAPAN)
KUKI CHOWA, EISEI KOGAKKAI
KENCHIKU KAIKAN
3-1, GINZA NISHI
CHUO-KU, TOKYO, JAPAN

KUKI SEIJO (JOURNAL OF JAPAN AIR CLEANING
ASSOCIATION)
NIHON KUKI SEIJI KYOKAI
NUSON KOGYO KAIKAN
1-4, KANDA JINBO-CHO
CHIYODA-KU, TOKYO, JAPAN

KUMAMOTO IGAKKAI ZASSHI (JOURNAL OF KUMAMOT
MEDICAL SOCIETY)
KUMAMOTO IGAKKAI
KUMAMOTO DAIGAKU IGAKUBU
HONJO-MACHI, KUMAMOTO-SHI
KUMAMOTO, JAPAN

LABORATORNOE DELO (LABORATORY WORK)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

LABORATORY PRACTICE
UNITED TRADE PRESS LTD.
9 GOUGH SQUARE
FLEET STREET
LONDON, ENGLAND
U.S. ADDRESS
LABORATORY PRACTICE
3701 CONNECTICUT AVENUE, N.W.
WASHINGTON, D.C. 20008

LANCET
LANCET
7 ADAM STREET
LONDON, ENGLAND

LANDARZT (STUTTGART)
HIPPOKRATES-VERLAG, GMBH
NECKARSTR. 121, POSTFACH 593
7000 STUTTGART, GERMANY

LANDTECHNIK
HELLMUT NEUREUTER VERLAG
POSTFACH 1349
819 WOLFRATSHAUSEN, GERMANY

LASCA LEAVES
CALIFORNIA ARBORETUM FOUNDATION INC.
BOX 688
ARCADIA, CALIF. 91006

LEAD ABSTRACTS
LEAD DEVELOPMENT ASSOCIATION
34 BERKELEY SQUARE
LONDON W. 1, ENGLAND

LEBENSMITTEL-INDUSTRIE
VEB FACHBUCHVERLAG
KARL-HEINE-STR 16
7031 LEIPZIG, E. GERMANY

LIFE SCIENCES
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

LILLE MEDICAL
LILLE MEDICAL
12, RUE LEPELLETIER
LILLE, FRANCE

LITEINOE PROIZVODSTVO (FOUNDRY PRODUCTION)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

LONDON CLINIC MEDICAL JOURNAL
LONDON CLINIC
20 DEVONSHIRE PLACE
LONDON, W1, ENGLAND

LUCAS ENGINEERING REVIEW
JOSEPH LUCAS INDUSTRIES LTD.
GREAT KING STREET
BIRMINGHAM 19, ENGLAND

M.T.Z. MOTORTECHNISCHE ZEITSCHRIFT
FRANCKH'SCHE VERLAGSCHANDLUNG
W. KELLER AND COMPANY
PFIZERSTR. 5-7
STUTTGART 1, GERMANY

MACHINE DESIGN
PENTON PUBLISHING COMPANY
PENTON BUILDING
CLEVELAND, OHIO 44113

MACHINERY (NEW YORK)
INDUSTRIAL PRESS INC.
200 MADISON AVENUE
NEW YORK, N.Y. 10016

MANAGEMENT
DANISH TECHNICAL PRESS
SKELBAEKGADE 4
COPENHAGEN V, DENMARK

MANUFACTURING CHEMIST AND AEROSOL NEWS
MORGAN-GRAMPIAN (PUBLISHERS) LTD.
28 ESSEX STREET
LONDON WC2, ENGLAND

MATERIALS HANDLING AND MANAGEMENT
TEMPRINT PRESS, LT..
65-66 TURNMILL STREET
LONDON EC1, ENGLAND

MATERIALS PROTECTION AND PERFORMANCE
NATIONAL ASSOCIATION OF CORROSION
ENGINEERS, INC.
2400 W LOOP, S.
HOUSTON, TEXAS 77027

MATERIALS RESEARCH AND STANDARDS
AMERICAN SOCIETY FOR TESTING AND
MATERIALS
1916 RACE STREET
PHILADELPHIA, PA. 19103

MECHANICAL ENGINEERING
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

MEDICAL ANNALS OF THE DISTRICT OF COLUMBIA
MEDICAL SOCIETY OF THE DISTRICT
OF COLUMBIA
2007 EYE STREET, N.W.
WASHINGTON, D.C. 20006

MEDICAL AND BIOLOGICAL ENGINEERING
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

MEDICAL JOURNAL OF AUSTRALIA
MEDICAL SOCIETY OF AUSTRALIA
SEAMER STREET
GLEBE, AUSTRALIA

MEDICAL JOURNAL OF MALAYA
STRAITS TIMES PRESS (M) BERHAD
TIMES HOUSE, RIVER VALLEY ROAD
SINGAPORE, SINGAPORE

MEDICINA DEL LAVORO
INDUSTRIAL MEDICINE
VIA S. BARNABA, 8
MILAN, ITALY

MEDICINE, SCIENCE AND THE LAW
THE BRITISH ACADEMY OF FORENSIC
SCIENCES, C/O THE LAW SOCIETY
1/3 CHANCERY LANE
LONDON, ENGLAND

MEDICO-LEGAL BULLETIN
COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HEALTH
OFFICE OF THE CHIEF MEDICAL EXAMINER
404-406 NORTH 12TH STREET
RICHMOND 19, VA.

Reproduced from best available copy.

MEDITSINSKI GLASNIK
MEDICINSKA KNJIGA
HOJANSKA 24
BELGRADE, YUGOSLAVIA

MEDIZINISCHE KLINIK (MUNICH)
URBAN UND SCHWARZENBERG
PETTENKOFERSTR. 18
8000 MUNICH 15, GERMANY

MEDIZINISCHE WELT
F.K. SCHATTAUER-VERLAG GMBH
P.O. BOX 29 45
7 STUTTGART, GERMANY

MEDYCYNA PRACY (LODZ)
RUCH
UL WRONIA 23
WARSAW 1, POLAND

METAL FINISHING JOURNAL
FUEL AND METALLURGICAL JOURNALS LTD.
JOHN ADAM HOUSE
17-19 JOHN ADAM STREET
LONDON, ENGLAND

METAL PROGRESS
AMERICAN SOCIETY FOR METALS
METALS PARK, OHIO 44073

METALL, ZEITSCHRIFT FUER TECHNIK, INDUSTRIE UND UND
HANDEL (BERLIN)
METALL-VERLAG GMBH
HUBERTUSALLEE 18
1 BERLIN, GERMANY
U.S. ADDRESS
INTERNATIONAL NEWSPAPER AND TRADE
ADVERTISING
1560 BROADWAY
NEW YORK, N.Y. 10036

METALLURGICAL TRANSACTIONS
METALLURGICAL SOCIETY OF A.I.M.E.
345 E. 47TH STREET
NEW YORK, N.Y. 10017

METEOROLOGICAL MAGAZINE
HER MAJESTY'S STATIONERY OFFICE
49 HIGH HOLBORN
LONDON WC1, ENGLAND

LA METEOROLOGIE (PARIS)
SOCIETE METEOROLOGIQUE DE FRANCE
1, QUAI BRANLY
PARIS, FRANCE

METEOROLOGISCHE RUNDSCHAU
SPRINGER-VERLAG
HEIDELBERGER PL. 3
BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

METEOROLOGIYA I GIDROLOGIYA (METEOROLOGY AND
HYDROLOGY)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

MICROCHEMICAL JOURNAL
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

MIE MEDICAL JOURNAL
MIE-KENRITSU DAIGAKU IGAKUBU
100, TORII-CHO
TSU, JAPAN

MIKROCHIMICA ACTA
SPRINGER-VERLAG
MOELKERBASTEI 5
VIENNA 1, AUSTRIA
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

MINERALS PROCESSING
MINERALS PROCESSING INC.
380 N.W. HIGHWAY
DES PLAINES, ILL. 60016

MINERVA MEDICA
EDIZIONI MINERVA MEDICA
CASELLA POSTALE 491
TURIN, ITALY

MINES MAGAZINE
CARTER KAANTA ED
1950 CURTIS STREET
DENVER, COLO. 80204

MINING CONGRESS JOURNAL
MINING CONGRESS JOURNAL
1100 RING BUILDING
WASHINGTON, D.C. 20036

MINING ENGINEER
THE INSTITUTION OF MINING ENGINEERS
3 GROSVENOR CRESCENT
LONDON, ENGLAND

MINING ENGINEERING
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

MITSUBISHI DENKI GIHO (MITSUBISHI DENKI TECHNICAL
REVIEW)
MITSUBISHI DENKI GIHO
MITSUBISHI DENKI BLDG., 2-12
MARUNOUCHI, CHIYODA-KU
TOKYO, JAPAN

MITTEILUNGEN DER VEREINIGUNG DER
GROSSKESSELBESITZER
VGB-DAMPFTECHNIK GMBH
KURFUERSTENSTR 27
43 ESSEN, GERMANY

MODERN CASTING
AMERICAN FOUNDRYMEN'S SOCIETY
GOLF AND WOLF ROAD
DES PLAINES, ILL. 60016

MODERN PLASTICS
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 10036

MODERN POWER AND ENGINEERING
MACLEAN-HUNTER LTD.
481 UNIVERSITY AVENUE
TORONTO, ONTARIO, CANADA

MONTHLY CATALOG OF U.S. GOVERNMENT PUBLICATIONS
SUPERINTENDENT OF DOCUMENTS
U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C. 20402

MONTHLY CHECKLIST OF STATE PUBLICATIONS
SUPERINTENDENT OF DOCUMETNS
U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C. 20402

MONTHLY WEATHER REVIEW
U.S. WEATHER BUREAU
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

MOTOR INDUSTRY RESEARCH ASSOCIATION
AUTOMOBILE ABSTRACTS
MOTOR INDUSTRY RESEARCH ASSOCIATION
LINDLEY, NEAR NUNEATON
WARWICKSHIRE, ENGLAND

MUENCHENER MEDIZINISCHE WOCHENSCHRIFT
J.F. LEHMANN
POSTFACH 210140
8 MUNICH, GERMANY

NARA IGAKU ZASSHI (JOURNAL OF THE NARA MEDICAL ASSOCIATION)
NARA IGAKKAI
NARA KENRITSU IKA DAIGAKU
SHIJOMACHI, KASHIWARA-SHI
NARA, JAPAN

NATIONAL ACADEMY OF SCIENCES PROCEEDINGS
NATIONAL ACADEMY OF SCIENCES,
PRINTING AND PUBLISHING OFFICE
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

NATIONAL COAL BOARD BOARD ABSTRACTS
HOBART HOUSE
GROSVENOR PLACE
LONDON SW 1, ENGLAND

NATIONAL ENGINEER
NATIONAL ASSOCIATION OF POWER ENGINEERS
176 W. ADAMS STREET
CHICAGO, ILL. 60603

NATIONAL SAFETY NEWS
NATIONAL SAFETY COUNCIL
425 N. MICHIGAN AVENUE
CHICAGO, ILL. 60611

NATION'S CITIES
CIRCULATION SECRETARY
NATION'S CITIES
1612 ''K'' STREET, N.W.
WASHINGTON, D.C. 20006

NATURE (LONDON)
MACMILLAN AND COMPANY LTD.
4 LITTLE ESSEX STREET
LONDON WC2, ENGLAND
U.S. ADDRESS
MACMILLAN COMPANY
866 THIRD AVENUE
NEW YORK, N.Y. 10022

NATURWISSENSCHAFTEN
SPRINGER-VERLAG
HEIDELBERGER PL. 3
BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

NATURWISSENSCHAFTLICHE RUNDSCHAU
WISSENSCHAFTLICHE VERLAGSGESELLSCHAFT MBH
POSTFACH 40
7 STUTTGART, GERMANY

NAVAL RESEARCH REVIEW
U.S. OFFICE OF NAVAL RESEARCH
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

NEDERLANDS TIJDSCHRIFT VOOR GENEESKUNDE
DE ERVEN F. BOHN, NAAMLOZE VENNOOTSCHAP
POSTBUS 66
HAARLEM, NETHERLANDS

NENRYO KYOKAI-SHI (JOURNAL OF THE FUEL SOCIETY OF JAPAN)
NENRYO KYOKAI
4-5, GINZA NISHI
CHUO-KU, TOKYO, JAPAN

NENRYO OYOBI NENSHO
21, KITAYAMA-CHO
TENNOJI-KU
OSAKA, JAPAN

NEPEGESZSEGUGY
KULTURA
P.O. BOX 149
BUDAPEST 62, HUNGARY

NETSU KANRI (HEAT MANAGEMENT)
CHUO NETSU KANRI KYOGIKAI
9, ICHIGAYA KAWADA-CHO
SHINJUKU-KU, TOKYO, JAPAN

NEUE HUETTE
VEB DEUTSCHER VERLAG FUER
GRUNDSTOFFINDUSTRIE
KARL-HEINE-STR 27
7031 LEIPZIG, E. GERMANY

NEW ENGLAND JOURNAL OF MEDICINE
MASSACHUSETTS MEDICAL SOCIETY
10 SHATTUCK STREET
BOSTON, MASS. 02115

NEW PHYTOLOGIST
BLACKWELL SCIENTIFIC PUBLICATIONS LTD.
5 ALFRED STREET
OXFORD, ENGLAND

NEW SCIENTIST
NEW SCIENCE PUBLICATIONS LTD.
CROMWELL HOUSE
FULWOOD PLACE, HIGH HOLBORN
LONDON, ENGLAND

NEW YORK STATE JOURNAL OF MEDICINE
MEDICAL SOCIETY OF THE STATE OF NEW YORK
EDITORIAL AND CIRCULATION OFFICE
750 THIRD AVENUE
NEW YORK, N.Y. 10017

NEW ZEALAND MEDICAL JOURNAL
OTAGO DAILY TIMES AND WITNESS
NEWSPAPERS COMPANY LTD.
P.O. BOX 181
DUNEDIN, NEW ZEALAND

NIHON GASU KYOKAISHI
JAPAN GAS ASSOCIATION
38 SHIBA KOTOHIRA-CHO
MINATO-KU, TOKYO, JAPAN

NIPPON GENSHIRYOKU GAKKAISHI (JOURNAL OF THE ATOMIC ENERGY SOCIETY OF JAPAN)
NIPPON GENSHIRYOKU GAKKAI
NIPPON GENSHIRYOKU KENKYUJO
1-CHOME, SHIBA TAMURA-CHO
MINATO-KU, TOKYO, JAPAN

NIPPON KAGAKU ZASSHI (JOURNAL OF THE CHEMICAL SOCIETY OF JAPAN, PURE CHEMISTRY SECTION)
NIPPON KAGAKKAI
1-5, KANDA SURUGADAI
CHIYODA-KU, TOKYO, JAPAN

NIPPON KINZOKU GAKKAISHI (JOURNAL OF THE JAPAN INSTITUTE OF METALS)
NIPPON KINZOKU GAKKAI
2-6, NIPPONBASHI-DORI
CHUO-KU, TOKYO, JAPAN

NIPPON KOGYO KAISHI (JOURNAL OF THE MINING AND METALLURGICAL INSTITUTE OF JAPAN)
NIPPON KOGYOKAI
8-7, GINZA NISHI
CHUO-KU, TOKYO, JAPAN

NIPPON NAIKA GAKKAI ZASSHI (JOURNAL OF THE JAPANESE SOCIETY OF INTERNAL MEDICINE)
NIPPON NAIKA GAKKAI
5GOU, 33 BAN 3-CHOME, HONGOU
BUNKYO-KU, TOKYO, JAPAN

NIPPON RINSHO (JAPANESE CLINICS)
NIPPON RINSHO-SHA
3-25, DOSHO-MACHI
HIGASHI-KU, OSAKA, JAPAN

NIPPON SHONIKA GAKKAI ZASSHI (JOURNAL OF THE JAPANESE PEDIATRICS SOCIETY)
NIPPON SHONIKA GAKKAI
NIPPON KOSHU EISEI KYOKAI BUILDING 78
HANAZONO-CHO SHINJUKU-KU
TOKYO, JAPAN

NORDISK HYGIENISK TILSKRIFT
PROF. GIDEON GEHARDSSON
ARBETSMEDICINSKA INSTITUTET
FACK, STOCKHOLM, SWEDEN

NORDISK MEDICIN
HUGO THEORELL, EDITOR
SVEAVAGEN 166, 1TR.
11346 STOCKHOLM, SWEDEN

NORSK SKOGINDUSTRI
NORWEGIAN WOOD INDUSTRY
RADHUSGATEN 7B
OSLO, NORWAY

NOVA SCOTIA MEDICAL BULLETIN
MEDICAL SOC. OF NOVA SCOTIA
DALHOUSIE PUBLIC HEALTH CLINIC
UNIVERSITY AVENUE
HALIFAX, NOVA SCOTIA, CANADA

NUCLEAR SAFETY
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20036

NUCLEAR SCIENCE AND ENGINEERING
AMERICAN NUCLEAR SOCIETY
244 E. OGDEN AVENUE
HINSDALE, ILL. 60521

NUOVA CHIMICA
NUOVA CHIMICA
SOLFERINO 32
20121 MILAN, ITALY

NUOVI ANNALI D'IGIENE E MICROBIOLOGIA (ROMA)
IL PENSIERO SCIENTIFICO EDITORE
VIA PANAMA 48
00198 ROME, ITALY

OCCUPATIONAL HEALTH REVIEW
DEPT. OF NATIONAL HEALTH AND WELFARE
OTTAWA, ONTARIO, CANADA

OCCUPATIONAL SAFETY AND HEALTH ABSTRACTS
INTERNATIONAL OCCUPATIONAL SAFETY AND
HEALTH INFORMATION CENTER
INTERNATIONAL LABORER OFFICE
GENEVA 22, SWITZERLAND

OCHRONA PRACY
RUCH
UL WRONIA 23
WARSAW 1, POLAND

OEFFENTLICHE GESUNDHEITSWESEN (STUTTGART)
GEORG THIEME VERLAG
HERDWEG 63
7000 STUTTGART 1, GERMANY

OEL- UND GASFEUERUNG
A.W. GENTNER
POSTFACH 688
7 STUTTGART, GERMANY

OESTERREICHISCHE INGENIEUR ZEITSCHRIFT
SPRINGER-VERLAG
HEIDELBERGER PL. 3
1 BERLIN 33, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10017

OHIO JOURNAL OF SCIENCE
OHIO JOURNAL OF SCIENCE
505 KING AVENUE
COLUMBUS, OHIO 43201

OIL AND GAS JOURNAL
PETROLEUM PUBLISHING COMPANY
FULFILLMENT MANAGER
P.O. BOX 1260
TULSA, OKLA. 74101

OKAYAMA-KEN EISEI KENKYUJYO NENPO (JAPAN)
HYGIENIC LABORATORY OF OKAYAMA PREFECTURE
TSUSHIMA, OKAYAMA-SHI,
OKAYAMA, JAPAN

OTOLARYNGOLOGY (SEE JIBI INKOKA)

OYO BUTSURI (JOURNAL OF APPLIED PHYSICS)
OYO BUTSURI GAKKAI
ROOM 209-2, KIKAI-SHINO BLDG. 21
SHIBA-KOEN MINATO-KU, TOKYO, JAPAN

PAINT, OIL AND COLOUR JOURNAL
SCOTT GREENWOOD AND SON, LTD.
83 FARRINGDON STREET
LONDON, ENGLAND

PAINT AND VARNISH PRODUCTION
PALMERTON PUBLISHING COMPANY INC.
101 W. 31ST STREET
NEW YORK, N.Y. 10001

PAPER TRADE JOURNAL
LOCKWOOD TRADE JOURNAL COMPANY INC.
551 FIFTH AVENUE
NEW YORK, N.Y. 10017

PAPERS IN METEOROLOGY AND GEOPHYSICS (TOKYO)
KISHO CHO KISHO KENKYUSHO
KOENJIKITA, SUGINA I
TOKYO, JAPAN

PATHOLOGIE ET BIOLOGIE
PATHOLOGIE ET BIOLOGIE
174, BLVD. SAINT-GERMAIN
PARIS, FRANCE

PATOLOGIA POLSKA
RUCH
UL WRONIA 23
WARSAW 1, POLAND

PEDIATRICS
PEDIATRICS
P.O. BOX 1034
EVANSTON, ILL. 60204

PENNSYLVANIA MEDICINE
PENNSYLVANIA MEDICAL SOCIETY
TAYLOR BYPASS AND ERFORD ROAD
LEMOYNE, PA. 17043

PENNSYLVANIA'S HEALTH
DEPARTMENT OF HEALTH
COMMONWEALTH OF PENNSYLVANIA
BOX 90
HARRISBURG, PA. 17120

PESTICIDES MONITORING JOURNAL
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

PETROLEUM REVIEW
INSTITUTE OF PETROLEUM
61 NEW CAVENDISH STREET
LONDON, ENGLAND

PHILOSOPHICAL MAGAZINE
TAYLOR AND FRANCIS LTD.
10 RED LION COURT
FLEET STREET
LONDON EC4, ENGLAND

PHYSICS ABSTRACTS
INSTITUTION OF ELECTRICAL AND ELECTRONIC
ENGINEERS, INC.
345 E. 47TH STREET
NEW YORK, N.Y. 10017

PHYSICS OF FLUIDS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

PHYSIOLOGIA PLANTARUM
MUNKSGAARD
PRAGS BLVD. 47
2300 COPENHAGEN S, DENMARK

PHYTOPATHOLOGY
M.F. KERNKAMP
1955 UNIVERSITY AVENUE
ST. PAUL, MINN. 55104

PIPELINE AND GAS JOURNAL
PETROLEUM ENGINEER PUBLISHING COMPANY
DAVIS BUILDING
P.O. BOX 1589
DALLAS, TEX. 75221

PIT AND QUARRY
PIT AND QUARRY
105 W. ADAMS STREET
CHICAGO, ILL. 60603

PLANETARY AND SPACE SCIENCE
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

PLANT DISEASE REPORTER
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402

PLANT ENGINEERING
TECHNICAL PUBLISHING COMPANY
308 E. JAMES STREET
BARRINGTON, ILL. 60010

PLANT OPERATIONS MANAGEMENT
CONOVER-MAST PUBLICATIONS, INC.
205 E. 42ND STREET
NEW YORK, N.Y. 10017

PLANT PHYSIOLOGY
AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS
P.O. BOX 5706
WASHINGTON, D.C. 20014

PLASTICKE HMOTY A KAUCUK
ARTIA
SMECKY 30
PRAGUE, 1. CZECHOSLOVAKIA

PLATINUM METALS REVIEW
JOHNSON, MATTHEY AND COMPANY LTD.
78 HATTON GARDEN
LONDON, ENGLAND

PLYN
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

PNEUMOLOGIE-PNEUMOLOGY
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

POLICLINICO, SEZIONE CHIRURGICA
POLICLINICO, SEZIONE CHIRURGICA
VIA PANAMA 68
00198 ROME, ITALY

POLICLINICO, SEZIONE MEDICA
POLICLINICO, SEZIONE MEDICA
VIA PANAMA, 68
00198 ROME, ITALY

POLLUTION - ITS IMPACT ON MENTAL HEALTH
SUPERINTENDENT OF DOCUMENTS
U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C. 20407

POLLUTION ABSTRACTS
POLLUTION ABSTRACTS
P.O. BOX 2369
LA JOLLA, CALIF. 92037

POLLUTION ATMOSPHERIQUE
POLLUTION ATMOSPHERIQUE
21, RUE MURILLO
PARIS, FRANCE

POLLUTION ENGINEERING
TECHNICAL PUBLISHING COMPANY
THOMPSON DIVISION
35 MASON STREET
GREENWICH, CONN. 06830

POLSKI TYGODNIK LEKARSKI
RUCH
UL WRONIA 23
WARSAW 1, POLAND

POLYTECHNISCH TIJDSCHRIFT: PROCESTECHNIEK
POSTBUS 375
CARNEGIEPLEIN 5
THE HAGUE
NETHERLANDS

POSTGRADUATE MEDICAL JOURNAL
BLACKWELL SCIENTIFIC PUBLICATIONS LTD.
5 ALFRED STREET
OXFORD, ENGLAND

POUMON ET LE COEUR (PARIS)
S.A.R.L. VIGOT FRERES EDITEURS
23 RUE DE MEDECINE
PARIS 6E, FRANCE

POWDER TECHNOLOGY
ELSEVIER PUBLISHING COMPANY
SPUISTRAAT 110-112
AMSTERDAM, NETHERLANDS
U.S. ADDRESS
AMERICAN ELSEVIER PUBLISHING COMPANY INC.
52 VANDERBILT AVENUE
NEW YORK, N.Y. 10017

POWER
POWER
P.O. BOX 430
HIGHTSTOWN, N.J. 08520

POWER ENGINEERING
TECHNICAL PUBLISHING COMPANY
308 E. JAMES STREET
BARRINGTON, ILL. 60010

PRACE INSTYTUT HUTNICZYCH
GLOWNY INSTYTUT METALURGIE ZELAZA
WIARKI 12
GLIWICACH, POLAND

PRACOVNI LEKARSTVI
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

PRAKTICKY LEKAR
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

PRAXIS (BERN)
PRAXIS, HALLWAG
3001 BERN, SWITZERLAND

PRIRODA
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

PROBLEMS OF ONCOLOGY U.S.S.R.
PERGAMON PRESS, INC.
122 EAST 55TH STREET
NEW YORK, N.Y. 10022

PROCEEDINGS OF THE AMERICAN PETROLEUM INSTITUTE
AMERICAN PETROLEUM INSTITUTE
1271 AVENUE OF THE AMERICAS
NEW YORK, N.Y. 10020

PROCEEDINGS OF THE AMERICAN POWER CONFERENCE
AMERICAN POWER CONFERENCE
ILLINOIS INSTITUTE OF TECHNOLOGY
CHICAGO, ILL. 6061[illegible]

PROCEEDINGS OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS
AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 RACE STREET
PHILADELPHIA, PA. 19103

PROCEEDINGS OF THE BRITISH CERAMIC SOCIETY
BRITISH CERAMIC SOCIETY
SHELTON HOUSE, STOKE ROAD
SHELTON, STOKE-ON-TRENT, ENGLAND

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS
INSTITUTION OF MECHANICAL ENGINEERS
1 BIRDCAGE WALK WESTMINSTER
LONDON, ENGLAND

PROCEEDINGS, NATIONAL ACADEMY OF SCIENCES
SEE NATIONAL ACADEMY SCIENCES

PROCEEDINGS OF THE ROYAL SOCIETY OF MEDICINE
H.K. LEWIS AND COMPANY LTD.
136 GOWER STREET
LONDON WC1, ENGLAND
U.S. ADDRESS
GRUNE AND STRATTON INC.
381 PARK AVENUE, S.
NEW YORK, N.Y. 10016

PROCEEDINGS OF THE ROYAL SOCIETY, SERIES A
ROYAL SOCIETY OF LONDON
6 CARLTON HOUSE TERRACE
LONDON, ENGLAND

PRODUCT ENGINEERING
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 10036

PRODUCTS FINISHING (CINCINNATI)
GARDNER PUBLICATIONS, INC.
431 MAIN STREET
CINCINNATI, OHIO 45202

PROTECTIO VITAE
MEDICI-VERLAG
CARL-ZEISS-STR. 18
3005 HANOVER-WESTERFELD
GERMANY

PRZEGLAD EPIDEMIOLOGICZNY
PANSTWOWY ZAKLAD HIGIENY
UL. CHOCIMSKA 24
WARSAW, POLAND

PUBLIC HEALTH (LONDON)
BAILLIERE, TINDALL AND CASSELL
7-8 HENRIETTA STREET
COVENT GARDEN, LONDON, ENGLAND

PUBLIC WORKS
PUBLIC WORKS JOURNAL CORPORATION
200 S. BROAD STREET
RIDGEWOOD, N.J. 07451

PULP AND PAPER MAGAZINE OF CANADA
NATIONAL BUSINESS PUBLICATIONS LTD.
GARDENVALE, QUEBEC, CANADA

PURE AND APPLIED CHEMISTRY
BUTTERWORTH AND COMPANY (PUBLISHERS) LTD.
88 KINGSWAY
LONDON WC1, ENGLAND

PURE AND APPLIED GEOPHYSICS
BIRKHAEUSER VERLAG
ELISABETHENSTR. 19
4000 BASEL 10, SWITZERLAND

QUARTERLY JOURNAL OF MEDICINE
OXFORD UNIVERSITY PRESS
ELY HOUSE, 37 DOVER STREET
LONDON EC4, ENGLAND
U.S. ADDRESS
OXFORD UNIVERSITY PRESS
1600 POLLITT DRIVE
FAIRLAWN, N.J. 07410

QUARTERLY JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY
ROYAL METEOROLOGICAL SOCIETY
49 CROMWELL ROAD
LONDON, SW7, ENGLAND

RADEX RUNESHAU
OESTERREICHISCH-AMERIKANISCHE
MAGNESIT AG
RADENTHEIN, AUSTRIA

RASSEGNA MEDICA SARDA
CLINICA DERMATOLOGICA DELL'UNIVERSITA
DI CAGLIARI
CASELLA POSTALE 170
CAGLIARI, ITALY

RECUEIL DE MEDECINE VETERINAIRE DE L'ECOLE D'ALFORT
VIGOT FRERES
23, RUE DE L'ECOLE-DE-MEDECINE
PARIS, FRANCE

REFRACTORIES (ENGLISH TRANSLATION OF OGNEUPORY)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

REFRACTORIES JOURNAL
LONDON AND SHEFFIELD
PUBLISHING COMPANY LTD.
7 CHESTERFIELD GARDENS, CURZON STREER
LONDON, ENGLAND

REMOTE SENSING OF ENVIRONMENT QUARTERLY
AMERICAN ELSEVIER PUBLISHING COMPANY, INC.
52 VANDERBILT AVENUE
NEW YORK, N.Y. 10017

RESEARCH/DEVELOPMENT
F.D. THOMPSON PUBLICATIONS, INC.
205 W. WACKER DRIVE
CHICAGO, ILL. 60606

RESEARCH QUARTERLY
COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCE
RUTGERS UNIVERSITY
NEW BRUNSWICK, N.J. 08903

RESPIRATION
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

RESPIRATION PHYSIOLOGY
NORTH-HOLLAND PUBLISHING COMPANY
P.O. BOX 103
AMSTERDAM C, NETHERLANDS

REVIEW OF SCIENTIFIC INSTRUMENTS
AMERICAN INSTITUTE OF PHYSICS
335 E. 45TH STREET
NEW YORK, N.Y. 10017

REVISTA DE CHIMIE
CARTIMEX
CASUTA POSTALA 134-135
BUCHAREST, ROMANIA

REVUE FRANCAISE DE L'ALLERGIE (PARIS)
EXPANSION SCIENTIFIQUE FRANCAISE
15 RUE SAINT-BENOIT
PARIS, FRANCE

REVUE GENERALE DE THERMIQUE
REVUE GENERALE DE THERMIQUE
2, RUE DES TANNERIES
PARIS, FRANCE

REVUE D'HYGIENE ET DE MEDECINE SOCIALE (PARIS)
MASSON ET CIE
120 BOULEVARD SAINT-GERMAIN
PARIS 6E, FRANCE

REVUE DE L'INSTITUT FRANCAIS DU PETROLE, ET ANNALES DES COMBUSTIBLES LIQUIDES
EDITIONS T.E.C.N.N.I.P.
7, RUE NELATON
75 PARIS, FRANCE

REVUE DE METALLURGIE (PARIS)
REVUE DE METALLURGIE
47, RUE BOISSIERE
PARIS, FRANCE

REVUE DE PATHOLOGIE COMPAREE ET DE MEDECINE EXPERIMENTALE
EDITIONS MEDICALES ET SCIENTIFIQUES
8 RUE DES ACACIAS
PARIS 17, FRANCE

REVUE ROUMAINE DE CHIMIE
CARTIMEX
CASUTA POSTALA 134-135
BUCHAREST, ROMANIA

REVUE DE LA SOCIETE ROYALE BELGE DES INGENIEURS ET DES INDUSTRIELS
HOTEL RAVENSTEIN
3, RUE RAVENSTEIN
BRUSSELS, BELGIUM

REVUE DE TUBERCULOSE ET DE PNEUMOLOGIE
MASSON ET CIE
120 BOULEVARD SAINT-GERMAIN
75 PARIS 6, FRANCE

RIVISTA DEI COMBUSTIBILI
TAMBURINI EDITORE SPA
VIA G. PASCOLI 55
20133 MILAN, ITALY

RIVISTA ITALIANA D'IGIENE
NISTRI-LISCHI EDITORI
V. CASTELLLETTO 7
PISA, ITALY

RIVISTA DE SANIDADE HYGIENE PUBLICA
DIRECCION GENERAL DE SANIDAD
APARTADO 1201
MADRID, SPAIN

ROADS AND STREETS
REUBEN H. DONNELLY CORPORATION
209 W. JACKSON BOULEVARD
CHICAGO, ILL. 60606

ROCK PRODUCTS
MACLEAN-HUNTER PUBLISHING CORPORATION
300 W. ADAMS STREET
CHICAGO, ILL. 60606

ROCKY MOUNTAIN MEDICAL JOURNAL
COLORADO MEDICAL SOCIETY
1609 E. 18TH AVENUE
DENVER, COLO. 80218

RODO KAGAKU (JOURNAL OF THE SCIENCE OF LABOR)
RODO KAGAKU KENKYUJO
SOSHIGAYA 2
SETAGAYA-KU, TOKYO, JAPAN

ROYAL SOCIETY OF HEALTH JOURNAL
ROYAL SOCIETY FOR THE PROMOTION OF HEALTH
90 BUCKINGHAM PALACE ROAD
LONDON, ENGLAND

RUBBER AGE
PALMERTON PUBLISHING COMPANY
101 W. 31ST STREET
NEW YORK, N.Y. 10001

RUBBER WORLD
BILL BROTHERS PUBLISHING CORPORATION
630 THIRD AVENUE
NEW YORK, N.Y. 10017

ROMANIAN MEDICAL REVIEW
CARTIMEX
CASUTA POSTALA 134-135
BUCHAREST, ROMANIA

RUSSIAN JOURNAL OF PHYSICAL CHEMISTRY
CHEMICAL SOCIETY
BURLINGTON HOUSE
PICCADILLY, LONDON W1, ENGLAND

S.A.E. AUSTRALASIA
SOCIETY OF AUTOMOTIVE ENGINEERS
AUSTRALASIA NATIONAL SCIENCE CENTER
191 ROYAL PARADE
PARKVILLE, VICTORIA 3052, AUSTRALIA

S.A.E. JOURNAL OF AUTOMOTIVE ENGINEERING
SOCIETY OF AUTOMOTIVE ENGINEERS
485 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

S.A.E. TRANSACTIONS (SOCIETY OF AUTOMOTIVE ENGINEERS)
SOCIETY OF AUTOMOTIVE ENGINEERS
485 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

S.P.E. JOURNAL (SOCIETY OF PLASTICS ENGINEERS)
SOCIETY OF PLASTICS ENGINEERS
656 W. PUTNAM AVENUE
GREENWICH, CONN. 06830

S.P.I.E. JOURNAL
SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS
216 AVENIDA DEL NORTE
BOX 288
REDONDO BEACH, CALIF. 90277

SACHISCHE AKADEMIE DER WISSENSCHAFTEN, LEIPZIG, MATHEMATISCH- NATURWISSENSCHAFTLICHE KLASSE ABHANDLUNGEN
AKADEMIE-VERLAG GMBH
LEIPZIGER STR 3-4
108 BERLIN W8, E. GERMANY

SALUD PUBLICA DE MEXICO
SECRETARIA DE SALUBRIDAD Y ASSISTENCIA
MEXICO CITY 1, MEXICO

SANGYO IGAKU (JAPANESE JOURNAL OF INDUSTRIAL HEALTH)
NIHON SANGYO EISEI KYOKAI
NIHON DAIGAKU IGAKUBU
KOSHU EISEIGAKU KYOSHITSU 30
OYAGUCHI KAMI-CHO, ITABASHI-KU
TOKYO, JAPAN

SANGYO KOGAI (PUBLIC NUISANCE)
SANGYO KOGAI BOSHI KYOKAI
KUDAN BUILDING, 2-2-5, KUDAN MINAMI
CHIYODA-KU, TOKYO, JAPAN

SANITAR UND HEIZUNGSTECHNIK
VERLAG A KRAMMER AND COMPANY
HERMANNSTR. 3
DUESSELDORF, WEST GERMANY

SCANDINAVIAN JOURNAL OF CLINICAL AND LABORATORY INVESTIGATION
UNIVERSITETSFORLAGET
P.O. BOX 307
OSLO, NORWAY
U.S. ADDRESS
P.O. BOX 142
BOSTON, MASS. 02113

SCHRIFTENREIHE DES VEREINS FUER WASSER-, BODEN- UND LUFTHYGIENE (BERLIN - DAHLEM)
GUSTAV FISCHER VERLAG
POSTFACH 431
7000 STUTTGART, GERMANY

Reproduced from
best available copy.

SCHWEIZERISCHE MEDIZINISCHE WOCHENSCHRIFT
SCHWABE + CO.
STEINENTORSTR
13, BASEL 10
SWITZERLAND

SCIENCE
AMERICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE
1515 MASSACHUSETTS AVENUE, N.W.
WASHINGTON, D.C. 20005

SCIENCE PROGRES DECOUNVERTE
DUNOD, EDITEUR
92, RUE BONAPARTE
PARIS, FRANCE

SCIENTIAE
SOUTH AFRICAN COUNCIL FOR SCIENTIFIC
AND INDUSTRIAL RESEARCH
P.O. BOX 395
PRETORIA, TRANSVAAL, S. AFRICA

SCIENTIFIC AMERICAN
SCIENTIFIC AMERICAN
415 MADISON AVENUE
NEW YORK, N.Y. 10017

SECURITAS (ROME)
ENTE NAZIONALE PREVENZIONE INFORTUNI
VIA ALESSANDRIA 220
ROME, ITALY

SEKIYU GAKKAI-SHI (JOURNAL OF THE JAPAN
PETROLEUM INSTITUTE)
SEKIYU GAKKAI
NISSEKI BLDG., 3-4, MARUNOUCHI
CHIYODA-KU, TOKYO, JAPAN

SEKIYU TO SEKIYU KAGAKU
SUZUKI BLDG.
1-5-2, SOTO KANDA
CHIYODA-KU, TOKYO, JAPAN

SHIKOKU IGAKU ZASSHI (SHIKOKU ACTA MEDICA)
TOKUSHIMA DAIGAKU IGAKUBU
KURAMOTO-CHO
TOKUSHIMA, JAPAN

SILIKAT TECHNIK
VEB VERLAG FUER BAUWESEN
FRANZOESISCHE STR. 13-14
108 BERLIN, GERMANY

SIMULATION
SIMULATION COUNCILS, INC.
STANLEY ROGERS
BOX 2228
LA JOLLA, CALIF. 92037

SMITHSONIAN
SMITHSONIAN INSTITUTION
WASHINGTON, D.C. 20560

SMOKING AND HEALTH BULLETIN
NATIONAL CLEARINGHOUSE FOR SMOKING AND HEALTH
[illegible]
4040 N. FAIRFAX DRIVE
ARLINGTON, VA. 22203

SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS
SEE S.P.I.E.

SOIL SCIENCE
WILLIAMS AND WILKINS COMPANY
428 E. PRESTON STREET
BALTIMORE, MD. 21202

SOIL SCIENCE SOCIETY OF AMERICA PROCEEDINGS
SOIL SCIENCE SOCIETY OF AMERICA
677 S. SEGOE RD.
MADISON, WIS. 53711

SOLAR ENERGY
SOLAR ENERGY SOCIETY
ARIZONA STATE UNIVERSITY
TEMPE, ARIZONA 85281

SOLID WASTES MANAGEMENT/REFUSE REMOVAL JOURNAL
RRJ PUBLISHING COMPANY
150 E. 52ND STREET
NEW YORK, N.Y. 10022

SOUTH AFRICAN CHEMICAL PROCESSING
THOMSON NEWSPAPERS SOUTH AFRICA LTD.
BOX 80
CAPE TOWN, SOUTH AFRICA

SOUTH AFRICAN JOURNAL OF LABORATORY AND CLINICAL
MEDICINE
MEDICAL ASSOCIATION OF SOUTH AFRICA
SECRETARY
P.O. BOX 643
CAPE TOWN, S. AFRICA

SOUTH AFRICAN MECHANICAL ENGINEER
KELVIN PUBLICATIONS LTD.
LOVEDAY STREET, LONDON HOUSE
JOHANNESBURG, S. AFRICA

SOUTH AFRICAN MEDICAL JOURNAL
MEDICAL ASSOCIATION OF SOUTH AFRICA
SECRETARY
P.O. BOX 643
CAPE TOWN, S. AFRICA

SOUTHERN ENGINEERING
W.R.C. SMITH PUBLISHING COMPANY
1760 PEACHTREE ROAD, N.W.
ATLANTA, GA. 30309

SOUTHERN MEDICAL JOURNAL
SOUTHERN MEDICAL ASSOCIATION
2601 HIGHLAND AVENUE
BIRMINGHAM, ALA. 35205

SOVETSKOE ZDRAVOOKHRANENIE (SOVIET PUBLIC HEALTH
SERVICES)
V/O "MEZHDUNARODNAYA KNIGA"
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

SOVIET ATOMIC ENERGY (ENGLISH TRANSLATION OF
ATOMNAYA ENERGIYA)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

SOVIET POWDER METALLURGY AND METAL CERAMICS
(ENGLISH TRANSLATION OF POROSHKOVAYA
METALLURGIYA)
PLENUM PUBLISHING CORPORATION
227 W. 17TH STREET
NEW YORK, N.Y. 10011

SOVIET RUBBER TECHNOLOGY (ENGLISH TRANSLATION OF
KAUCHUK I REZINA)
MACLAREN AND SONS, LTD.
P.O. BOX 109
CROYDON, SURREY, ENGLAND
[illegible]
PALMERTON PUBLISHING COMPANY INC.
101 WEST 31ST STREET
NEW YORK, N.Y. 10001

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

STA[illegible]
[illegible]
[illegible]
[illegible]

STA[illegible]
[illegible]
[illegible]
[illegible]

STA[illegible]
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION DIVISION
[illegible]

STAUB
VDI-VERLAG GMBH
POSTFACH 1139
4 DUESSELDORF 1, W. GERMANY

STEAM AND HEATING ENGINEER
TROUP PUBLICATIONS LTD.
35 RED LION SQUARE
LONDON WC1, ENGLAND

STEEL TIMES
FUEL AND METALLURGICAL JOURNALS LTD.
JOHN ADAM HOUSE, 17-19 JOHN ADAM STREET
LONDON, ENGLAND

STRAHLENTHERAPIE
URBAN UND SCHWARZENBERG
PETTENKOFERSTR. 18
8000 MUNICH 15, GERMANY

STUDIA GEOPHYSICA ET GEODAETICA
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

SURFACE SCIENCE
NORTH-HOLLAND PUBLISHING COMPANY
P.O. BOX 103
AMSTERDAM C, NETHERLANDS

SURVEYOR (LONDON)
TEMPLE PRESS LTD
BOWLING GREEN LANE
LONDON EC1, ENGLAND

SVENSK FARMACEUTISK TIDSKRIFT
APOTEKARSOCIETETEN
UPPLANDSGATAN 6A
STOCKHOLM, SWEDEN

SVENSK PAPPERSTIDNING (THE SWEDISH PAPER JOURNAL)
APOTEKARSOCIETETEN
WALLINGATEN 26
10554 STOCKHOLM C, SWEDEN

SWISS TECHNICS (ENGLISH EDITION)
SWISS OFFICE FOR THE DEVELOPMENT
OF TRADE
AVENUE BELLEFONTAINE 18
LAUSANNE, SWITZERLAND

T.N.O. NIEUWS
UITGEVERSMIJ KRUTY NV
GROOT HERTOGINNELAAN 28
BUSSUM, NETHERLANDS

TAIKI OSEN KENKYO (JOURNAL OF JAPAN SOCIETY
OF AIR POLLUTION)
TAIKI OSEN KENKYU ZENKOKU KYOGIKAI
KOKURITSU KOSHU EISEI-IN, 1-39
SHIBA SHIROGANE DAI-MACHI
MINATO-KU, TOKYO, JAPAN

TALANTA
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

TAPPI (TECHNICAL ASSOCIATION OF THE PULP AND PAPER
INDUSTRY)
TECHNICAL ASSOCIATION OF THE PULP
AND PAPER INDUSTRY
360 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

TECHNICAL REVIEW OF THE MITSUBISHI HEAVY INDUSTRIES
(TOKYO)
MITSUBISHI JUKOGYO K. K.
10, 2-CHOME, MIRUNOUCHI
CHIYODA-KU, TOKYO, JAPAN

TECHNIK (BERLIN)
VEB VERLAG TECHNIK
ORANIENBURGER STR 13-14
102, BERLIN, GERMANY

TECHNIQUE MODERNE
DUNOD
92 RUE BONAPARTE
75 PARIS (6E), FRANCE

TECHNISCHE MITTEILUNGEN
VULKAN-VERLAG DR. W. CLASSEN,
NACHF. GMBH. AND COMPANY
KG, HOUS DER TECHNIK
43 ESSEN, GERMANY

TECHNISCHE MITTEILUNGEN KRUPP FORSCHUNGSBERICHTE
FRIEDRICH KRUPP GMBH
FACHBUECHEREI, POSTFACH 917
43 ESSEN, GERMANY

TECHNOLOGY REVIEW
ALUMNI ASSOCIATION
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS. 02139

TEKNILLINEN AIKAKAUSLEHTI
TEKNILLINEN AIKAKAUSLEHTI
RATAKATU 9
HELSINKI, FINLAND

TEKNISK TIDSKRIFT
SVENSKA TEKNOLOGFORENINGEN
BOX 841
STOCKHOLM 1, SWEDEN

TEKNISK UKEBLAD
INGENIOERFORLAGET A/S
KRONPRINSENSGT 17
OSLO, NORWAY

TELLUS
SVENSKA GEOFYSISKA FORENINGEN
BOX 19111, S-104
32 STOCKHOLM, 19, SWEDEN

TEPLOENERGETIKA (THERMAL POWER ENGINEERING)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

TERMOTECNICA (MILAN)
TERMOTECNICA
VIA MARCONA 49
20129 MILAN, ITALY

TETRAHEDRON
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

TETRAHEDRON LETTERS
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

TETSU TO HAGANE (JOURNAL OF THE IRON AND STEEL
INSTITUTE OF JAPAN)
NIPPON TEKKO KYOKAI
KEIDANREN KAIKAN, 5
OTEMACHI-1-CHOME
CHIYODA-KU, TOKYO, JAPAN

TEXAS AGRICULTURAL EXPERIMENT STATION PROGRESS REPORT
TEXAS A AND M UNIVERSITY
TEXAS AGRICULTURAL EXPERIMENT STATION
COLLEGE STATION, TEX. 77843

TEXAS MEDICINE (AUSTIN)
TEXAS MEDICAL ASSOCIATION
1801 N. LAMAR BOULEVARD
AUSTIN, TEXAS 78701

TEXAS REPORTS ON BIOLOGY AND MEDICINE
TEXAS REPORTS
UNIVERSITY OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS 77550

TEXTILE RESEARCH JOURNAL
TEXTILE RESEARCH INSTITUTE
P.O. BOX 625
PRINCETON, N.J. 08540

TEXTILE WORLD
MCGRAW-HILL PUBLICATIONS
330 W. 42ND STREET
NEW YORK, N.Y. 10036

TEXTILVEREDLUNG
THURGAUER TAGBLATT
VERLAG SCHLAEPFER AG
8570 WEINFELDEN TG, SWITZERLAND

33, MAGAZINE OF THE METALS PRODUCING INDUSTRY
OPEC INC.
24 COMMERCE STREET
NEWARK, N.J.

THORAX (BRITISH MEDICAL ASSOCIATION)
BMA HOUSE
TAVISTOCK SQUARE
LONDON, ENGLAND
U.S. ADDRESS
BRITISH MEDICAL JOURNAL
80 BRIGHTON AVENUE
BOSTON, MASS. 02134

TIJDSCHRIFT VOOR SOCIAL GENEESKUNDE
TIJDSCHRIFT VOOR SOCIAL GENEESKUNDE
12 MINDERBROEDERSSTR
LOUVAIN, BELGIUM

TIN AND ITS USES
TIN RESEARCH INSTITUTE
FRASER ROAD
GREENFORD, ENGLAND
U.S. ADDRESS
TIN RESEARCH INSTITUTE
483 W. 6TH STREET
COLUMBUS, OHIO 04320

TOBACCO INTERNATIONAL
LOCKWOOD TRADE JOURNAL COMPANY INC.
551 FIFTH AVENUE
NEW YORK, N.Y. 10017

TOKUSHIMA-KEN EISEI KENKYUJYO NENPO (TOKYO)
TOKUSHIMA PREFECTURE PUBLIC HEALTH LABORATORY
SHINKURA-CHO
TOKUSHIMA-SHI
TOKUSHIMA, JAPAN

TOKYO KOGYO SHIKENSHO HOKOKU
TSUSHO SANGYO-SHO KOGYO GIJUTSU-
IN TOKYO KOGYO SHIKENSHO
1-1, HON MACHI
SHIBUYA-KU, TOKYO, JAPAN

TONINDUSTRIE - ZEITUNG UND KERAMISCHE RUNDSCHAU
HERMANN HUEBENER VERLAG KG
POSTFACH 68
3380 GOSLAR, GERMANY

TOXICOLOGY AND APPLIED PHARMACOLOGY
ACADEMIC PRESS, INC.
111 FIFTH AVENUE
NEW YORK, N.Y. 10003

TRANSACTIONS OF THE A.S.A.E. (AMERICAN SOCIETY OF
AGRICULTURAL ENGINEERS)
AMERICAN SOCIETY OF AGRICULTURAL
ENGINEERS
420 MAIN STREET
ST. JOSEPH, MICHIGAN 49085

TRANSACTIONS OF THE AMERICAN GEOPHYSICAL UNION
AMERICAN GEOPHYSICAL UNION
SUITE 506, 1145 19 STREET, N.W.
WASHINGTON, D.C. 20036

TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY
AMERICAN NUCLEAR SOCIETY
244 E. OGDEN AVENUE
HINSDALE, ILL. 60521

TRANSACTIONS OF THE BRITISH CERAMIC SOCIETY
THE BRITISH CERAMIC SOCIETY
SHELTON HOUSE
STOKE-ON-TRENT, ENGLAND

TRANSACTIONS OF THE FARADAY SOCIETY
ABERDEEN UNIVERSITY PRESS, LTD.
FARMERS HALL
ABERDEEN, SCOTLAND

TRANSACTIONS OF THE INSTITUTION OF CHEMICAL
ENGINEERS
INSTITUTION OF CHEMICAL ENGINEERS
16 BELGRAVE SQUARE
LONDON, ENGLAND

TRANSACTIONS OF THE MEDICAL SOCIETY OF LONDON
MEDICAL SOCIETY OF LONDON
11 CHANDOS STREET
CAVENDISH SQUARE
LONDON, ENGLAND

TRANSACTIONS OF THE NEW YORK ACADEMY OF SCIENCES
NEW YORK ACADEMY OF SCIENCES
EXECUTIVE DIRECTOR
2 E. 63RD STREET
NEW YORK, N.Y. 10021

TRANSACTIONS OF THE SOCIETY OF HEATING, AIR
CONDITIONING, AND SANITARY ENGINEERS OF JAPA
KUKI CHOWA EISEI KOGAKKAI
C/O KENCHIKU KAIKAN, 3-1, NISHI GINZA
CHUO-KU, TOKYO, JAPAN

TRANSACTIONS OF THE SOCIETY OF MINING ENGINEERS
OF A.I.M.E.
AMERICAN INSTITUTE OF MINING,
METALLURGICAL AND PETROLEUM ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

TRANSACTIONS AND STUDIES OF THE COLLEGE OF
PHYSICIANS OF PHILADELPHIA
COLLEGE OF PHYSICIANS OF PHILADELPHIA
19 S. 22ND STREET
PHILADELPHIA, PA. 19103

TRANSPORTATION RESEARCH (OXFORD)
PERGAMON PRESS
HEADINGTON HILL HALL
OXFORD, ENGLAND
U.S. ADDRESS
PERGAMON PRESS INC.
MAXWELL HOUSE, FAIRVIEW PARK
ELMSFORD, N.Y. 10523

TREND IN ENGINEERING
UNIVERSITY OF WASHINGTON
ENGINEERING EXPERIMENT STATION
127 MORE HALL
SEATTLE, WASH. 98105

TRIBUNE DU CEBEDEAU
EDITION C.E.B.E.D.O.C.
3 BOULEVARD FRERE ORBAN
LIEGE, BELGIUM

TRUDY INSTITUTA PRIKLADNOI GEOFIZIKI, MOSCOW
(LENINGRAD)
INSTITUT PRIKLADNOI GEOFIZIKI
GLEBOVSKAYA ULITSA, 20-B
MOSCOW, U.S.S.R.

TRUDY LENINGRADSKOGO SANITARNO - GIGIENICHESKOGO
MEDITSINSKOGO INSTITUTA
ST. CENTRAL SCIENTIFIC MEDICAL LIBRARY
INTERNATIONAL BOOK EXCHANGE
SADOVO-KUDRINSKAIA, I.
MOSCOW G-68, U.S.S.R.

TSVETNYE METALLY (NON-FERROUS METALS)
V/O "MEZHDUNARODNAYA KNIGA"
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

HLI
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

UKRAINS'KYI BIOKHIMICHNYI ZHURNAL (KIEV)
AKADEMIIA NAUK UKRAYINS'KOYI R.S.R.
INSTYTUT BIOKHIMIIA
LEONTOVYCHA 9
KIEV 30, U.S.S.R.

UMSCHAU IN WISSENSCHAFT UND TECHNIK
UMSCHAU VERLAG
STUTTGARTER STR. 18-24
6 FRANKFURT AM MAIN, WEST GERMANY

UMWELT
VDI VERLAG GMBH
GRAF RECKE STR. 84
POSTFACH 1139
4 DUESSELDORF 1
WEST GERMANY

U.S. BUREAU OF MINES, NEW PUBLICATIONS
U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20240

UNIVERSITY OF MICHIGAN MEDICAL CENTER JOURNAL
UNIVERSITY OF MICHIGAN MEDICAL CENTER
55[illegible]7 UNIVERSITY HOSPITAL
ANN ARBOR, MICHIGAN 48104

UTAH ACADEMY OF SCIENCES, ARTS AND LETTERS, PROCEEDINGS
UNIVERSITY OF UTAH
[illegible] L. CARRUTH, SECY-TR.
SALT LAKE CITY, UTAH 84112

UZBEKSKII KHIMICHESKII ZHURNAL
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

V.D.I. BERICHTE
VDI-VERLAG GMBH
POSTFACH 1139
4 DUESSELDORF, GERMANY

V.D.I. FORSCHUNGSHEFT
VDI-VERLAG GMBH
POSTFACH 1139
4 DUESSELDORF, GERMANY

V.D.I.-NACHRICHTEN
VDI VERLAG GMBH
GRAF RECKE STR. 84
POSTFACH 1139
4 DUESSELDORF 1
WEST GERMANY

V.D.I. ZEITSCHRIFT
VDI-VERLAG GMBH
POSTFACH 1139
4 DUESSELDORF, GERMANY

VERHANDLUNGEN DER DEUTSCHEN GESELLSCHAFT FUER PATHOLOGIE
GUSTAV FISCHER VERLAG
POSTFACH 431
7000 STUTTGART, GERMANY

VESTNIK AKADEMII MEDITSINSKIKH NAUK S.S.S.R.
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

VESTNIK AKADEMII NAUK S.S.S.R.
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

VIRGINIA MEDICAL MONTHLY
MEDICAL SOCIETY OF VIRGINIA
4205 DOVER ROAD
RICHMOND, VA. 23221

VNITRNI LEKARSTVI
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

VODOSNABZHENIE I SANITARNAYA TEKHNIKA
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

VOPROSY ONKOLOGII
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

VRACHEBNOE DELO (MEDICAL PROFESSION)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

W.H.O. CHRONICLE (WORLD HEALTH ORGANIZATION)
WORLD HEALTH ORGANIZATION
DISTRIBUTION AND SALES UNIT
GENEVA, SWITZERLAND

WAERME STOFFUEBERTRAGUNG
SPRINGER-VERLAG
HEIDELBERGER PLATZ 3
1 BERLIN 33, W. GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

WASEDA DAIGAKU RIKOGAKU KENKYUSHO HOKOKU (BULLETIN OF SCIENTIFIC AND ENGINEERING RESEARCH LABORATORY, WASEDA UNIVERSITY)
WASEDA DAIGAKU RIKOGAKU KENKYUSHO
17, KIKUI-CHO, SHINJUKU-KU
TOKYO, JAPAN

WASSER LUFT UND BETRIEB
KG KRAUSS KOPF-VERLAG FUER
WIRTSCHAFT GMBH
LESSINGSTR 12-14
65 MAINZ, GERMANY
U.S. ADDRESS
ILIFFE-NTP INC.
300 E. 42ND STREET
NEW YORK, N.Y. 10017

WATER POLLUTION CONTROL
INSTITUTE OF WATER POLLUTION CONTROL
49-55 VICTORIA STREET
LONDON, ENGLAND

WATER AND SEWAGE WORKS
SCRANTON PUBLISHING COMPANY INC.
35 E. WACKER DRIVE
CHICAGO, ILL. 60601

WATER AND WASTES ENGINEERING
REUBEN H. DONNELLEY CORPORATION
466 LEXINGTON AVENUE
NEW YORK, N.Y. 10017

WEATHER
WEATHER
49 CROMWELL ROAD
LONDON, ENGLAND

WERKSTOFFE UND KORROSION
VERLAG CHEMIE GMBH
PAPPELALLEE 3
6940 WEINHEIM/BERGSTR., GERMANY

WEST AFRICAN MEDICAL JOURNAL
JOURNAL AND MAGAZINE PRODUCTION
SERVICES (WEST AFRICA) LTD.
PRIVATE MAIL BAG 12002
LAGOS, NIGERIA

WESTERN CITY
LEAGUE OF CALIFORNIA CITIES
702 STATLER CENTER
LOS ANGELES, CALIF. 90017

WESTINGHOUSE ENGINEER
WESTINGHOUSE ENGINEER
3 GATEWAY CENTER
PITTSBURGH, PA. 15230

WIADOMOSCI HUTNICZE
RUCH
UL WRONIA 23
WARSAW 1, POLAND

WIRE AND WIRE PRODUCTS
HAIRE PUBLISHING COMPANY
111 FOURTH AVENUE
NEW YORK, N.Y. 10003

WISCONSIN MEDICAL JOURNAL
WISCONSIN MEDICAL SOCIETY
P.O. BOX 1109
MADISON, WIS. 53701

WISSENSCHAFTLICHE ZEITSCHRIFT DER TECHNISCHEN
HOCHSCHULE FUER CHEMIE ''CARL SCHORLEMMER''
LEUNA-MERSEBURG
DEUTSCHER BUCHEXPORT UND -IMPORT GMBH
LENINSTR 16
701 LEIPZIG, E. GERMANY

WISSENSCHAFTLICHE ZEITSCHRIFT DER TECHNISCHEN
UNIVERSITAETS DRESDEN
BUCHHANDLUNG DER TECHNISCHEN
UNIVERSITAET DRESDEN
VOLKSBUCHHANDLUNG, NUERNBERGER STR 63
8027 DRESDEN, GERMANY
OR
DEUTSCHE POST
ZEITUNGSVERTRIEBSAMT
EXPORTABTEILUNG, FRUCHSTR 3-4
BERLIN, E. GERMANY

WORK - ENVIRONMENT - HEALTH (HELSINKI)
WORK-ENVIRONMENT-HEALTH
INSTITUTE OF OCCUPATIONAL HEALTH
HELSINKI, FINLAND

WORLD PETROLEUM
KATSUNARI TOYODA
NEW ICHIGAYA BLDG., 4-CHOME
KUDAN MINAMI, CHIYODA-KU
TOKYO, JAPAN
U.S. ADDRESS
J. BARRY MCKENNA, EASTERN SALES
25 W. 45TH STREET
NEW YORK, N.Y. 10036

YALE SCIENTIFIC MAGAZINE
YALE UNIVERSITY
YALE SCIENTIFIC MAGAZINE
244-A YALE STATION
NEW HAVEN, CONN. 06520

YOKOHAMA MEDICAL BULLETIN
YOKOHAMA IKA DAIGAKU
URAFUNE-CHO, MINATO-KU
YOKOHAMA, JAPAN

YONSEI MEDICAL JOURNAL
YONSEI UNIVERSITY COLLEGE OF MEDICINE
INTERNATIONAL P.O. BOX 1010
SEOUL, S. KOREA

YOSUI TO HAISUI (WATER AND WASTE)
INDUSTRIAL WATER INSTITUTE
SENDAGAYA, SHIBUYA-KU
TOKYO, JAPAN

ZAVODSKAYA LABORATORIYA (FACTORY LABORATORY)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ZDRAVOTNI TECHNIKA A VZDUCHOTECHNIKA
ARTIA
SMECKY 30
PRAGUE 1, CZECHOSLOVAKIA

ZEITSCHRIFT FUER ANORGANISCHE UND ALLGEMEINE
CHEMIE
JOHANN AMBROSIUS BARTH VERLAG
SALOMONSTR. 18B
701 LEIPZIG CL., E. GERMANY

ZEITSCHRIFT FUER ERZBERGBAU UND
METALLHUTTENWESEN
DR. RIEDERER-VERLAG GMBH.
POSTFACH 447
7, STUTTGART, GERMANY

ZEITSCHRIFT FUER DIE GESAMTE HYGIENE UND
IHRE GRENZGEBIETE
VEB GEORG THIEME
HAINSTR. 17
701 LEIPZIG, E. GERMANY

ZEITSCHRIFT FUER IMMUNITAETSFORSCHUNG, ALLERGIE
UND KLINESCHE IMMUNOLOGIE
GUSTAV FISCHER VERLAG
POSTFACH 431
7000 STUTTGART, GERMANY

ZEITSCHRIFT FUER KREBSFORSCHUNG
J.F. BERGMANN
TROGERSTR 56
8 MUNICH, GERMANY
U.S. ADDRESS
SPRINGER-VERLAG
175 FIFTH AVENUE
NEW YORK, N.Y. 10010

ZEITSCHRIFT FUER METEOROLOGIE
AKADEMIE-VERLAG GMBH.
LEIPZIGER STR. 3-4
108 BERLIN W8, E. GERMANY

ZEITSCHRIFT FUER PFLANZENKRANKHEITEN
PFLANZENPATHOLOGIE UND PFLANZENSCHUTZ
VERLAG EUGEN ULMER
GEROKSTR. 19
7000 STUTTGART, GERMANY

ZEITSCHRIFT FUER PHYSIKALISCHE CHEMIE (LEIPZIG)
AKADEMISCHE VERLAGSGESELLSCHAFT
GEEST UND PORTIG K-G
STERNWARTENSTR 8
LEIPZIG, E. GERMANY

ZEITSCHRIFT FUR PRAEVENTIVMEDIZIN
ANT. INSTITUT ORELL FUESSLI AG
ZEITSCHRIFTENABTEILUNG
DIETZINGERSTR 3
8022 ZURICH, SWITZERLAND

ZEMENT - KALK - GIPS
BAUVERLAG GMBH
KLEINE WILHELMSTR. 7
62 WIESBADEN, GERMANY

ZENTRALBLATT FUER ARBEITSMEDIZIN UND
ARBEITSSCHUTZ
DR. DIETRICH STEINKOPFF VERLAG
SAALBAUSTR. 12
6100 DARMSTADT, GERMANY

ZENTRALBLATT FUER BAKTERIOLOGIE, PARASITENKUNDE,
INFEKTIONSKRANKHEITEN UND HYGIENE, ABTEILUNG I
ORIGINALE
GUSTAV FISCHER VERLAG
POSTFACH 431
7000 STUTTGART, GERMANY

ZHURNAL ANALITICHESKOI KHIMII (MOSCOW)
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ZHURNAL PRIKLADNOI KHIMII
V/O ''MEZHDUNARODNAYA KNIGA''
KUZNETSKII MOST 18
MOSCOW G-200, U.S.S.R.

ZINC ABSTRACTS
ZINC DEVELOPMENT ASSOCIATION
34 BERKELEY SQUARE
LONDON W. 1, ENGLAND

ZUCKER
VERLAG M. UND H. SCHAPER
POSTFACH 260669
3 HANNOVER, GERMANY

☆U.S. GOVERNMENT PRINTING OFFICE 1973 514-151/151 1-3